FIG. 1 (PRIOR ART)

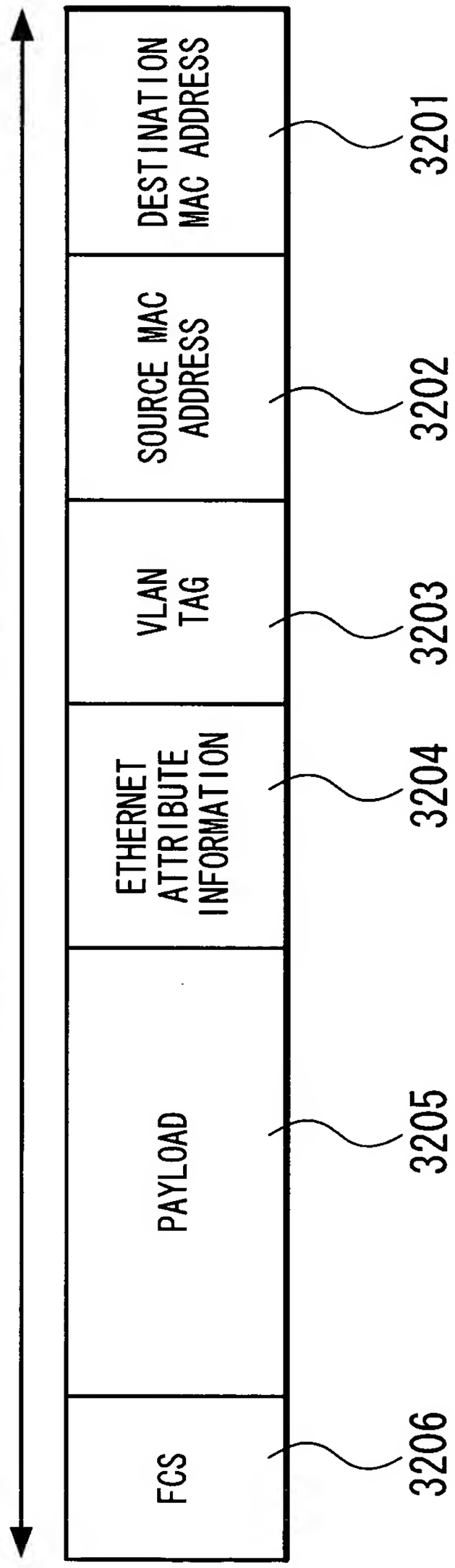


FIG. 2

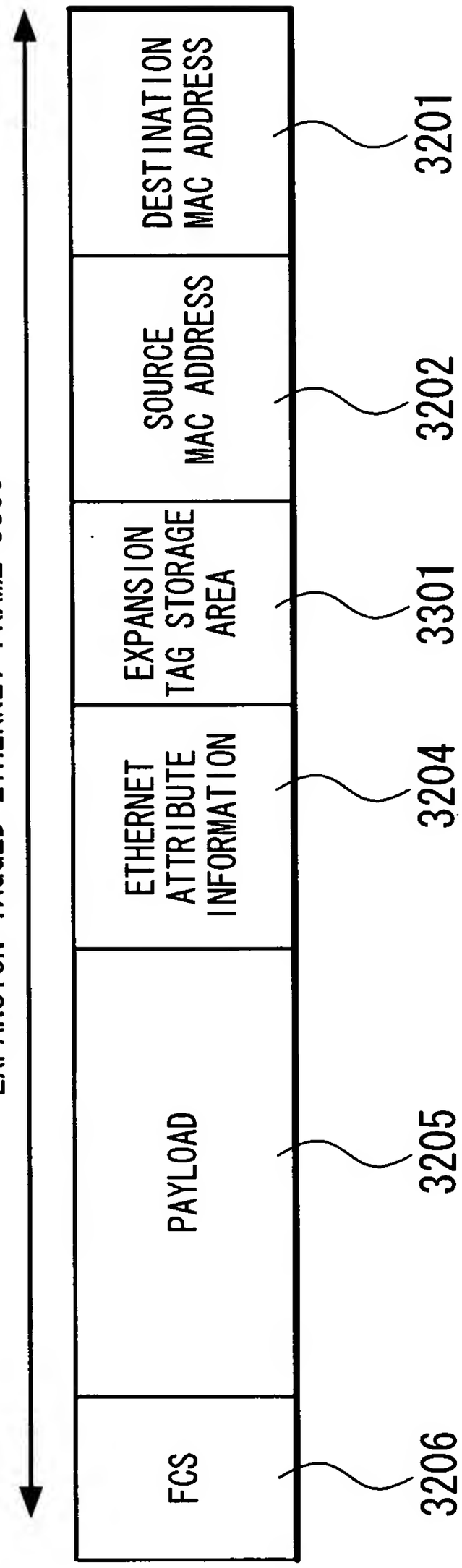
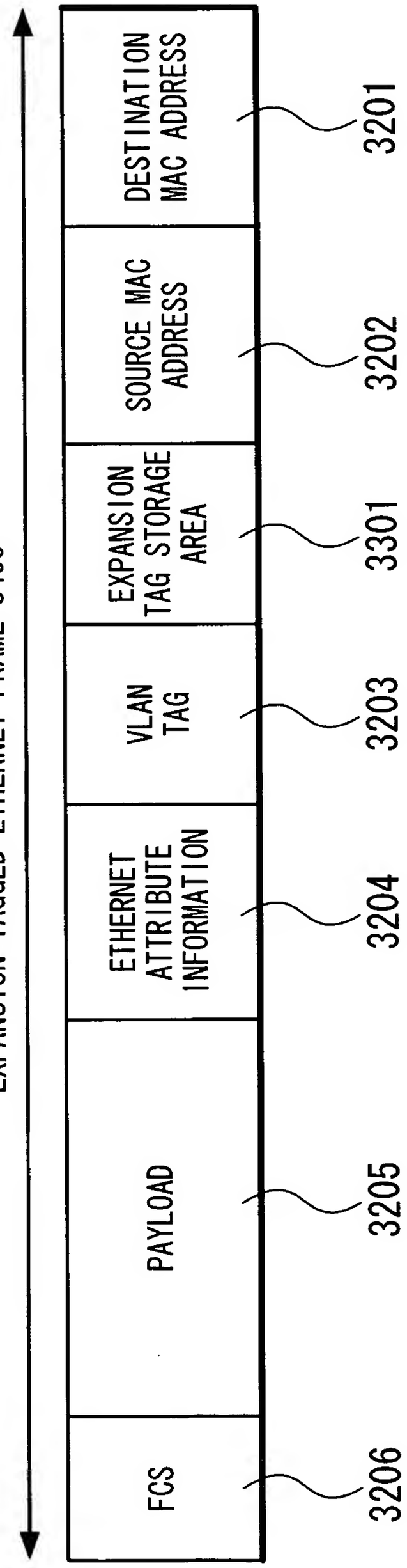

EXPANSION TAGGED ETHERNET FRAME 3300
DESTINATION MAC ADDRESS
3201
SOURCE MAC ADDRESS
3202
EXPANSION TAG STORAGE AREA
3301
ETHERNET ATTRIBUTE INFORMATION
3204
PAYLOAD
3205
FCS
3206

FIG. 3


EXPANSION TAGGED ETHERNET FRAME 3400
DESTINATION MAC ADDRESS
3201
SOURCE MAC ADDRESS
3202
ETHERNET ATTRIBUTE INFORMATION
3204
VLAN TAG
3203
EXPANSION TAG STORAGE AREA
3301
PAYLOAD
3205
FCS
3206

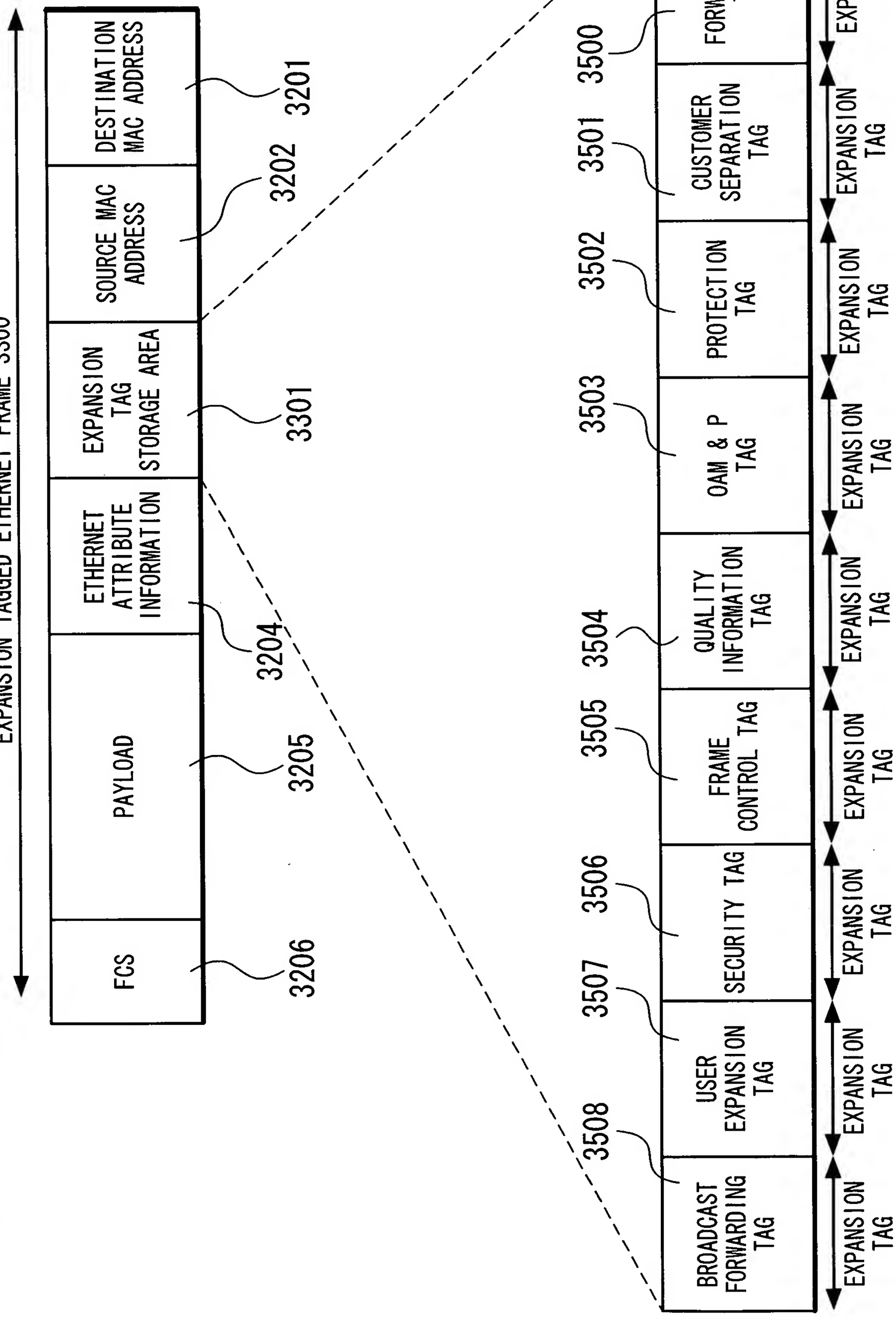

EXPANSION TAGGED ETHERNET FRAME 3300
DESTINATION MAC ADDRESS
SOURCE MAC ADDRESS
EXPANSION TAG STORAGE AREA
ETHERNET ATTRIBUTE INFORMATION
PAYLOAD
FCS
3201
3202
3301
3204
3205
3206
3500
3501
3502
3503
3504
3505
3506
3507
3508
FORWARDING TAG
CUSTOMER SEPARATION TAG
PROTECTION TAG
OAM & P TAG
QUALITY INFORMATION TAG
FRAME CONTROL TAG
SECURITY TAG
USER EXPANSION TAG
BROADCAST FORWARDING TAG
EXPANSION TAG

FIG. 4

FIG. 5

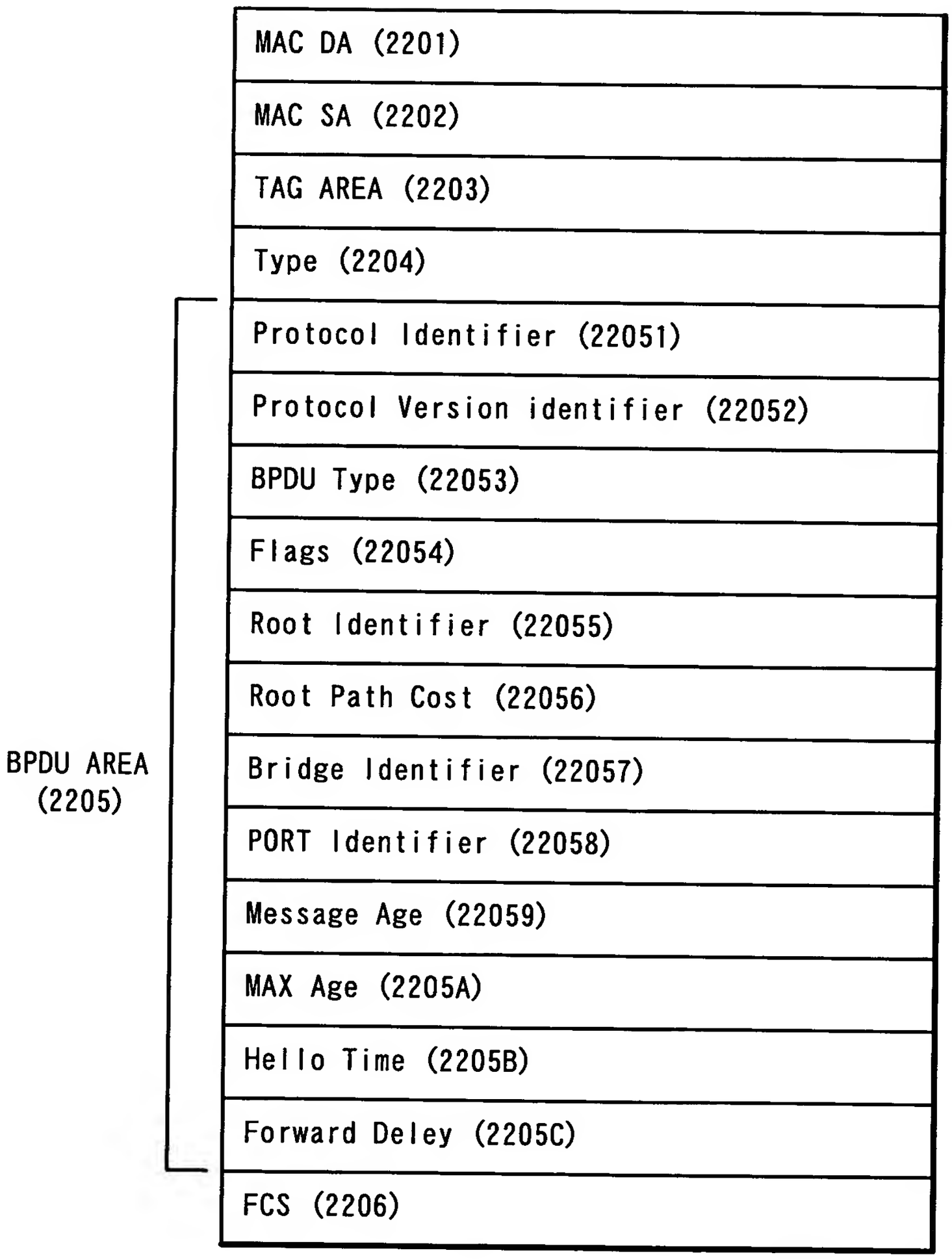

MAC DA (2201)
MAC SA (2202)
TAG AREA (2203)
Type (2204)
BPDU AREA (2205)
Protocol Identifier (22051)
Protocol Version identifier (22052)
BPDU Type (22053)
Flags (22054)
Root Identifier (22055)
Root Path Cost (22056)
Bridge Identifier (22057)
PORT Identifier (22058)
Message Age (22059)
MAX Age (2205A)
Hello Time (2205B)
Forward Deley (2205C)
FCS (2206)

FIG. 6

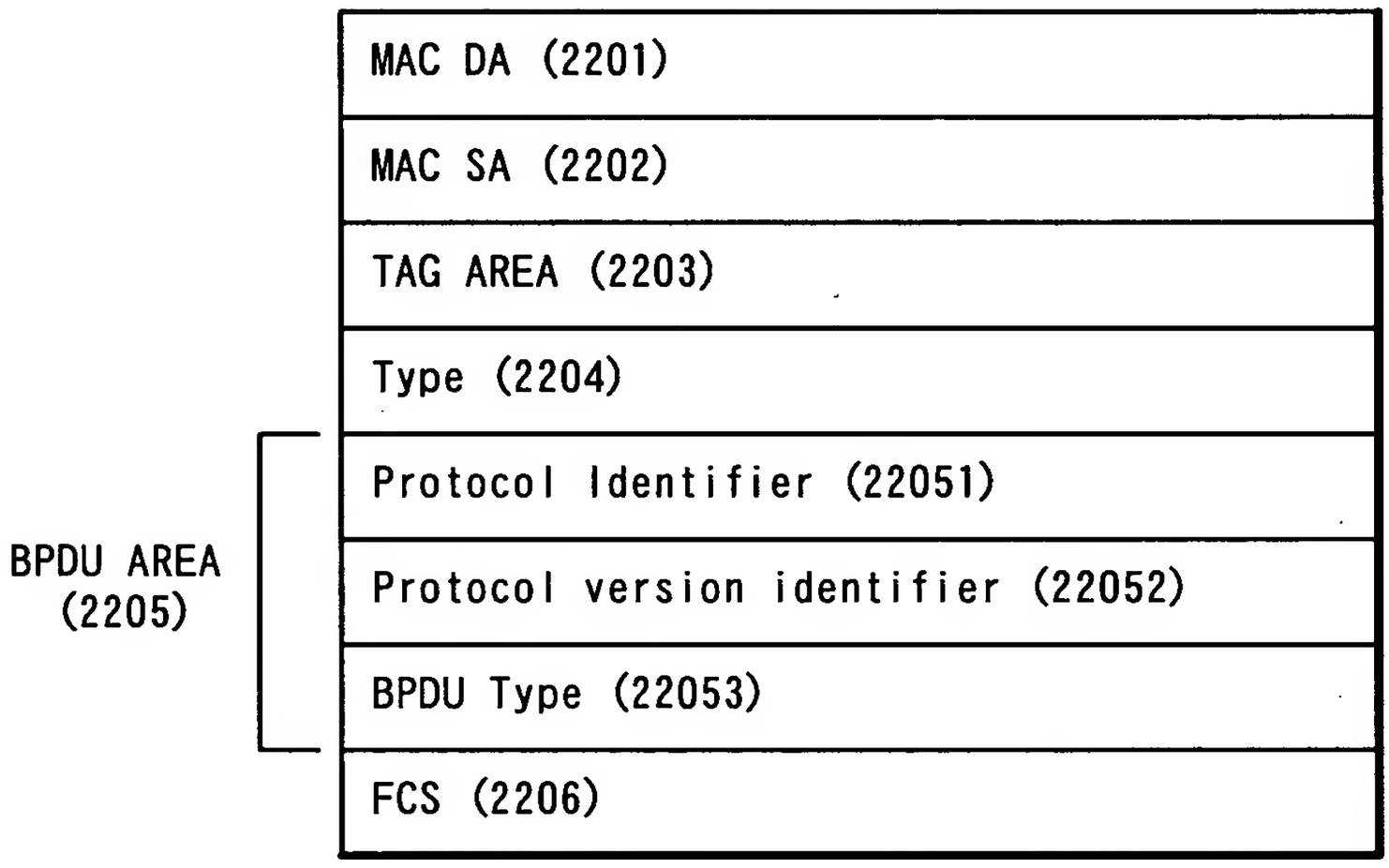

MAC DA (2201)
MAC SA (2202)
TAG AREA (2203)
Type (2204)
Protocol Identifier (22051)
Protocol version identifier (22052)
BPDU Type (22053)
FCS (2206)
BPDU AREA (2205)

FIG. 7

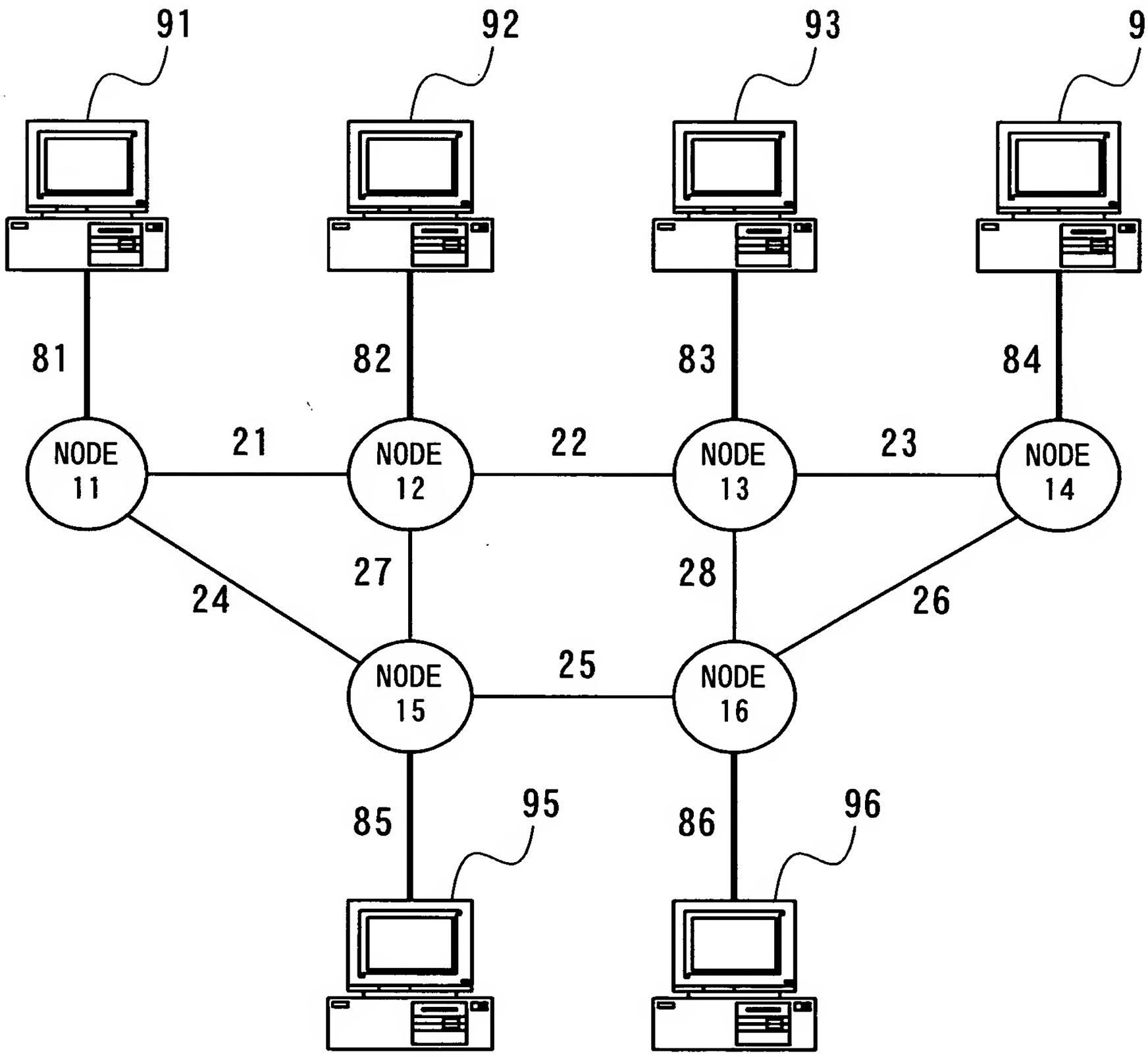

91
92
93
94
81
82
83
84
NODE 11
NODE 12
NODE 13
NODE 14
21
22
23
24
27
28
26
NODE 15
NODE 16
25
85
95
86
96

FIG. 8

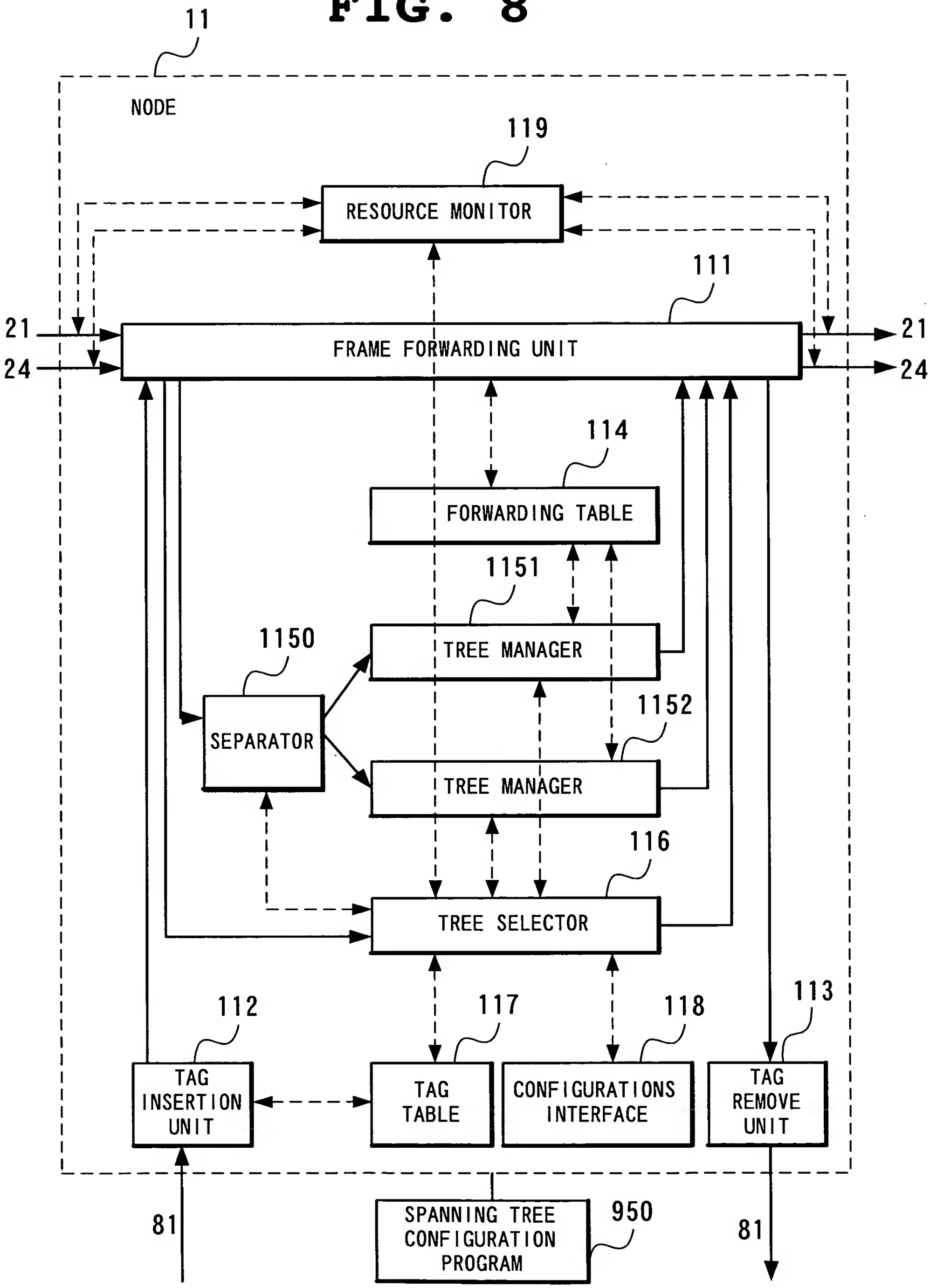

11
NODE
119
RESOURCE MONITOR
111
21
24
FRAME FORWARDING UNIT
21
24
114
FORWARDING TABLE
1151
1150
TREE MANAGER
SEPARATOR
1152
TREE MANAGER
116
TREE SELECTOR
112
117
118
113
TAG INSERTION UNIT
TAG TABLE
CONFIGURATIONS INTERFACE
TAG REMOVE UNIT
81
SPANNING TREE CONFIGURATION PROGRAM
950
81

FIG. 9

114

TAG 1141	OUTPUT PORT 1142
CURRENT SYSTEM TAG	PORT2 (EXAMPLE)
AUXILIARY SYSTEM TAG	PORT1 (EXAMPLE)

FIG.10

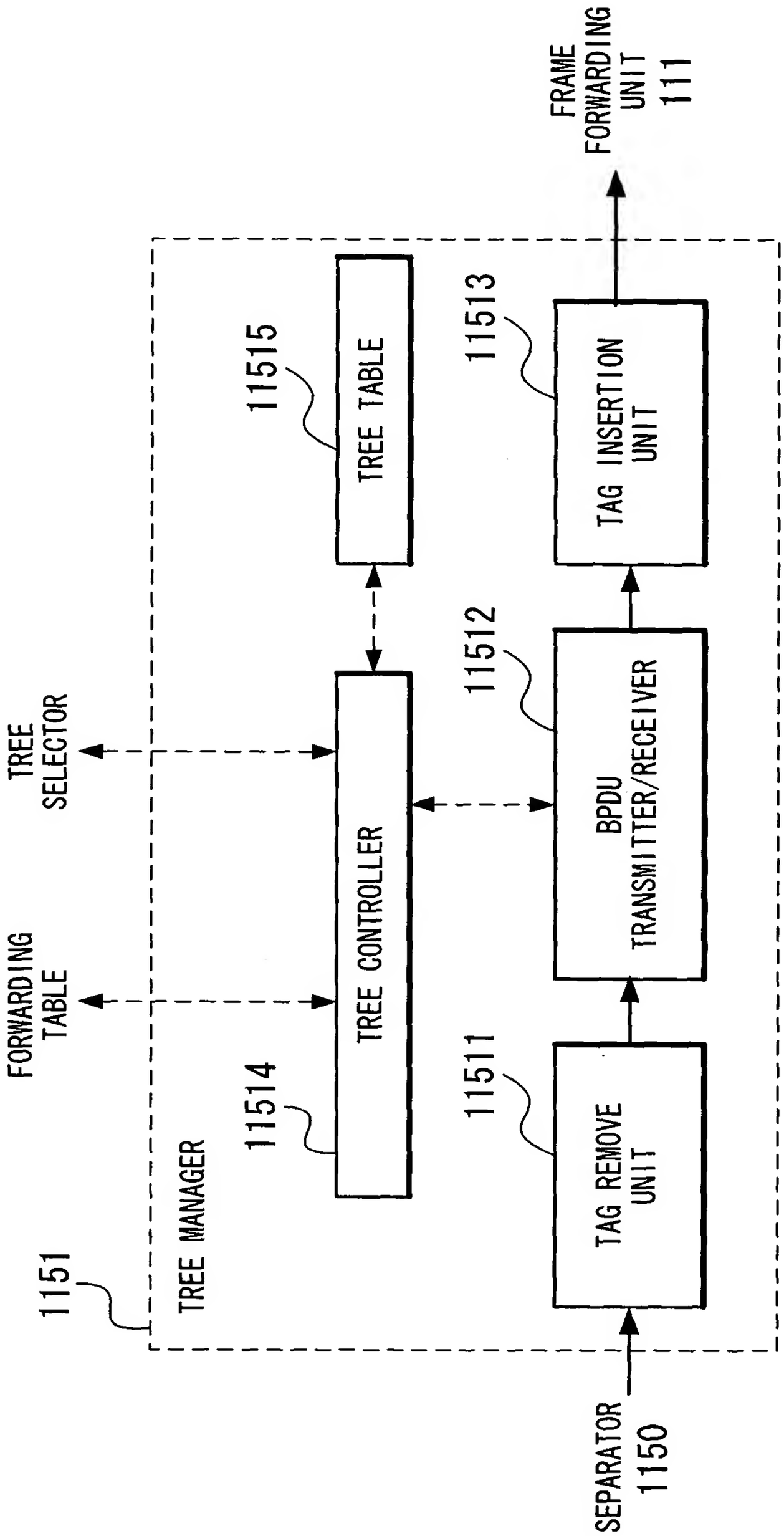

FRAME FORWARDING UNIT 111
11515
TREE TABLE
11513
TAG INSERTION UNIT
116 TREE SELECTOR
11512
BPDU TRANSMITTER/RECEIVER
114 FORWARDING TABLE
TREE CONTROLLER
11511
11514
1151
TAG REMOVE UNIT
TREE MANAGER
1151
SEPARATOR 1150

FIG. 11

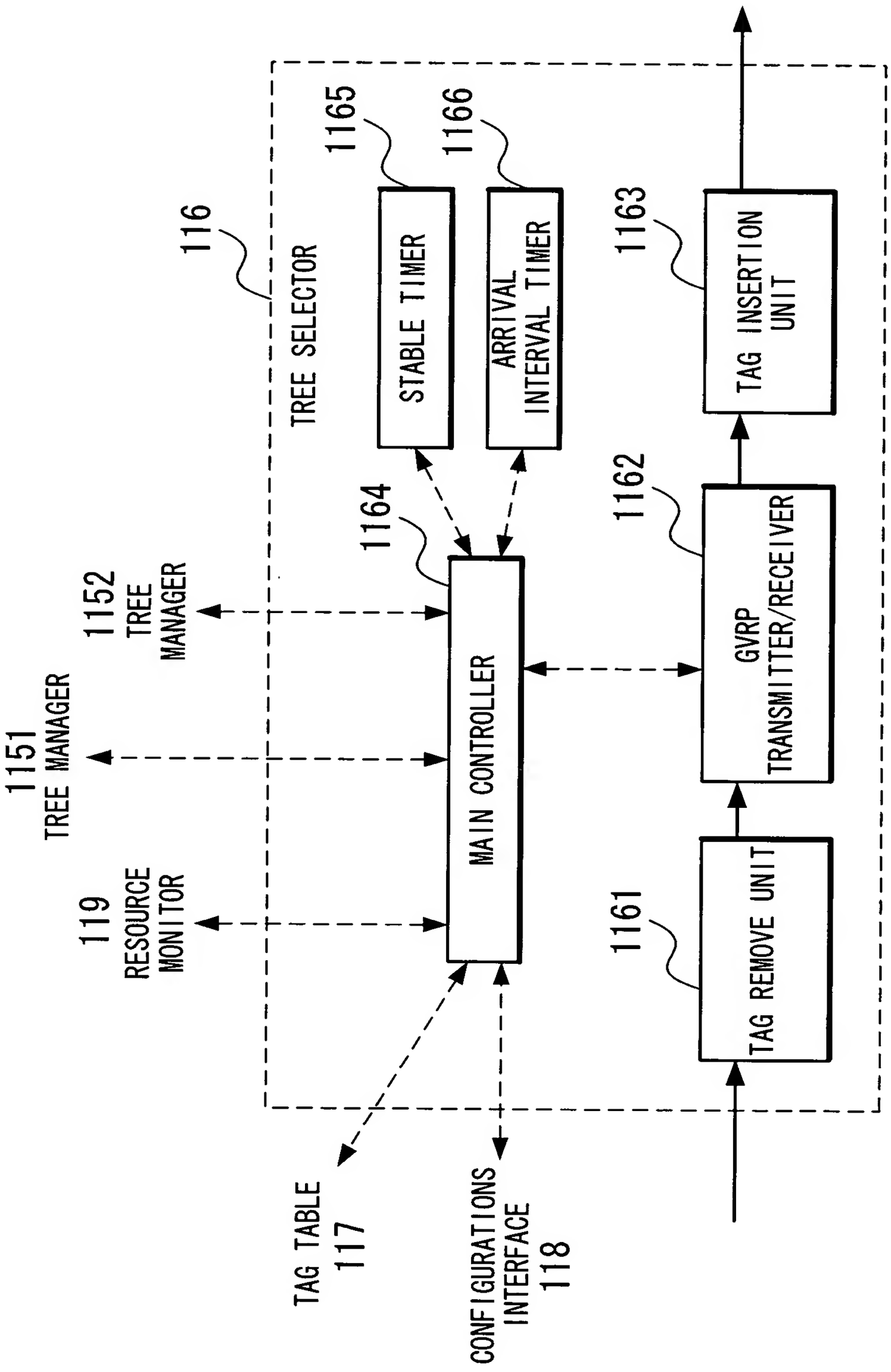

116
TREE SELECTOR
1165
STABLE TIMER
1166
ARRIVAL
INTERVAL TIMER
1163
TAG INSERTION
UNIT
1151
TREE MANAGER
1152
TREE
MANAGER
1164
MAIN CONTROLLER
1162
GVRP
TRANSMITTER/RECEIVER
119
RESOURCE
MONITOR
1161
TAG REMOVE UNIT
TAG TABLE
117
CONFIGURATIONS
INTERFACE
118

FIG.12

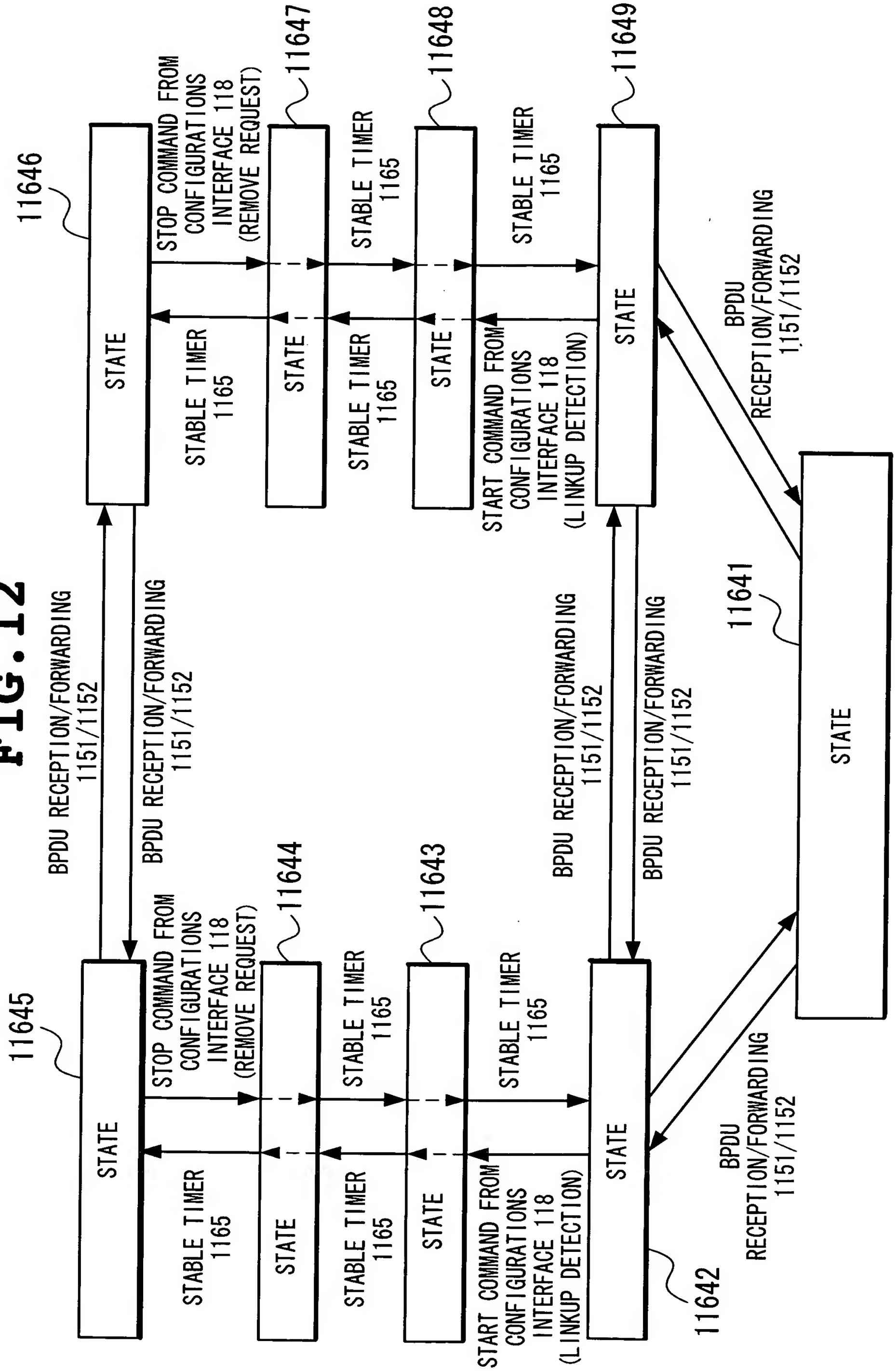

11646
STATE
STOP COMMAND FROM CONFIGURATIONS INTERFACE 118 (REMOVE REQUEST)
11647
STABLE TIMER 1165
STATE
STABLE TIMER 1165
11648
STATE
STABLE TIMER 1165
START COMMAND FROM CONFIGURATIONS INTERFACE 118 (LINKUP DETECTION)
11649
STATE
BPDU RECEPTION/FORWARDING 1151/1152
BPDU RECEPTION/FORWARDING 1151/1152
11644
11643
BPDU RECEPTION/FORWARDING 1151/1152
BPDU RECEPTION/FORWARDING 1151/1152
11641
STATE
11645
STATE
STOP COMMAND FROM CONFIGURATIONS INTERFACE 118 (REMOVE REQUEST)
STABLE TIMER 1165
STATE
STABLE TIMER 1165
STATE
STABLE TIMER 1165
START COMMAND FROM CONFIGURATIONS INTERFACE 118 (LINKUP DETECTION)
STATE
11642
BPDU RECEPTION/FORWARDING 1151/1152

FIG.13

117

DESTINATION MAC ADDRESS 1171	INSERTION TAG 1172
VALUE REPRESENTING ALL THE NODES ON THE ENTIRE NETWORK	ID OF THE TAG GROUP THAT IS THE CURRENT SYSTEM NOW

FIG.14

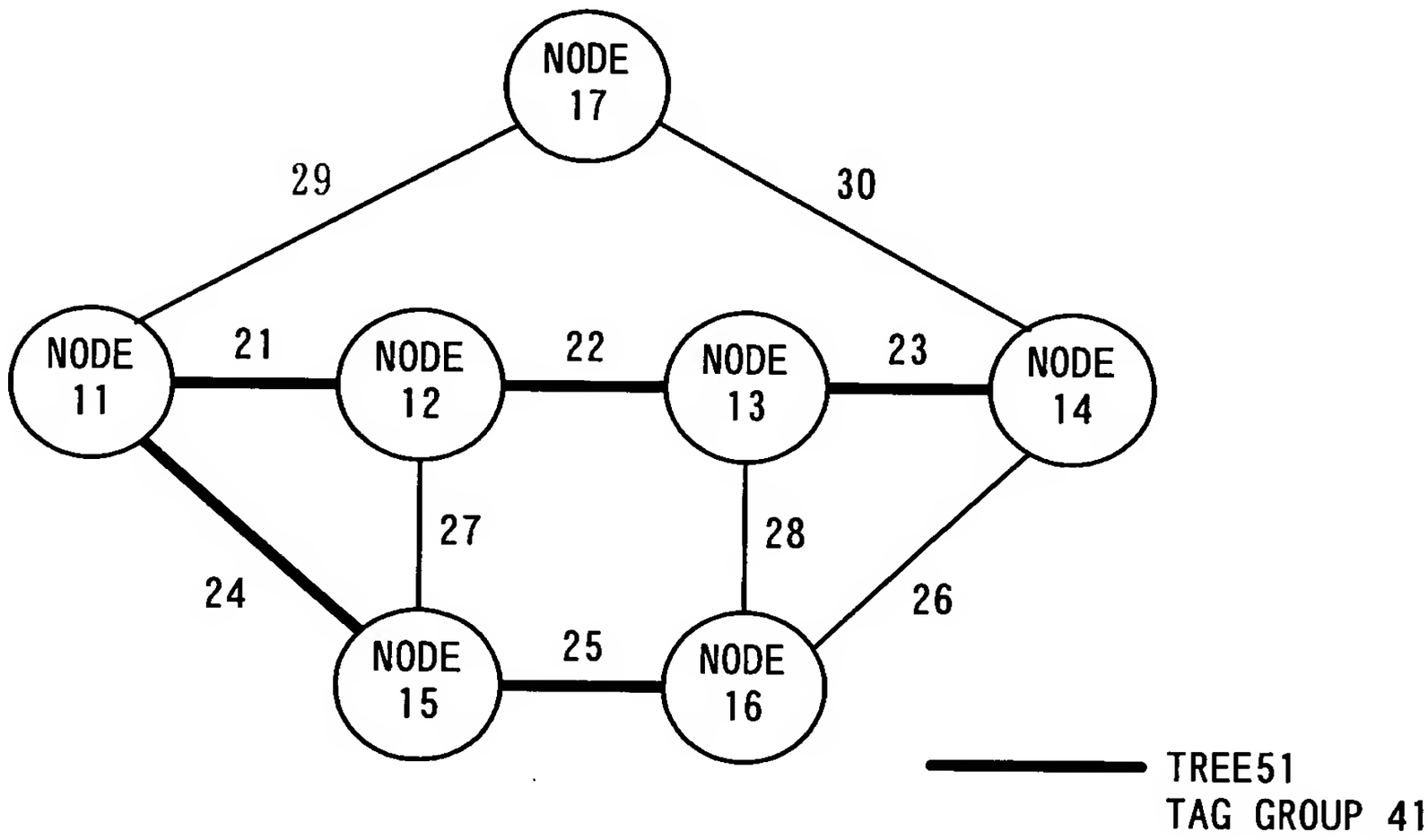
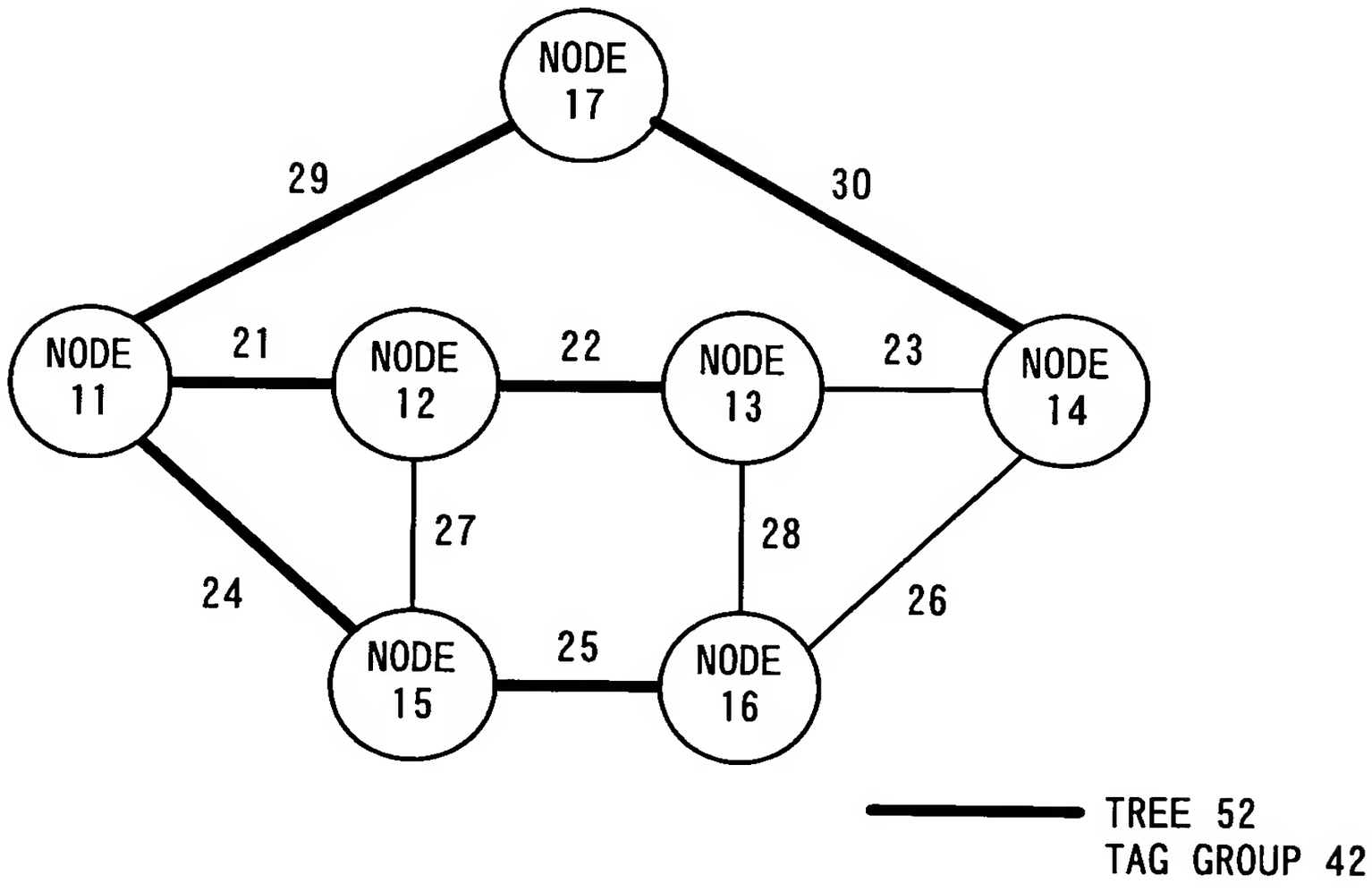


FIG.15


NODE 17
29
30
NODE 11
21
NODE 12
22
NODE 13
23
NODE 14
27
28
24
26
NODE 15
25
NODE 16
TREE 52
TAG GROUP 42

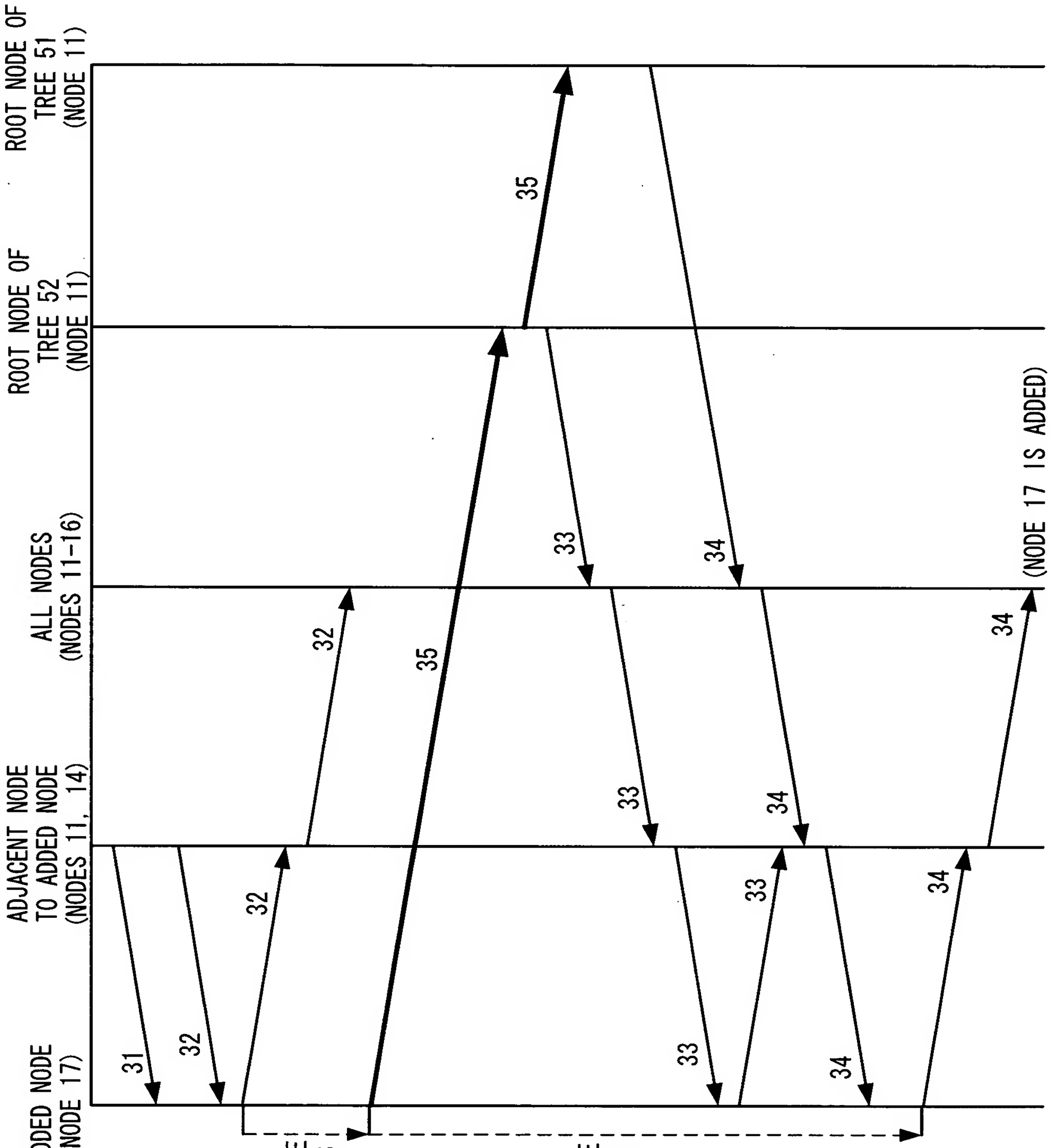

ROOT NODE OF TREE 51 (NODE 11)
ROOT NODE OF TREE 52 (NODE 11)
ALL NODES (NODES 11-16)
ADJACENT NODE TO ADDED NODE (NODES 11, 14)
ADDED NODE (NODE 17)
(NODE 17 IS ADDED)
35
33
34
32
31
STABLE TIMER 1165 (DURING THIS TIME, NODE 17 DOES NOT SEND BPDUS 31, 34)
STABLE TIMER 1165 (DURING THIS TIME, NODE 17 DOES NOT SEND BPDUS 31, 34)

FIG 16

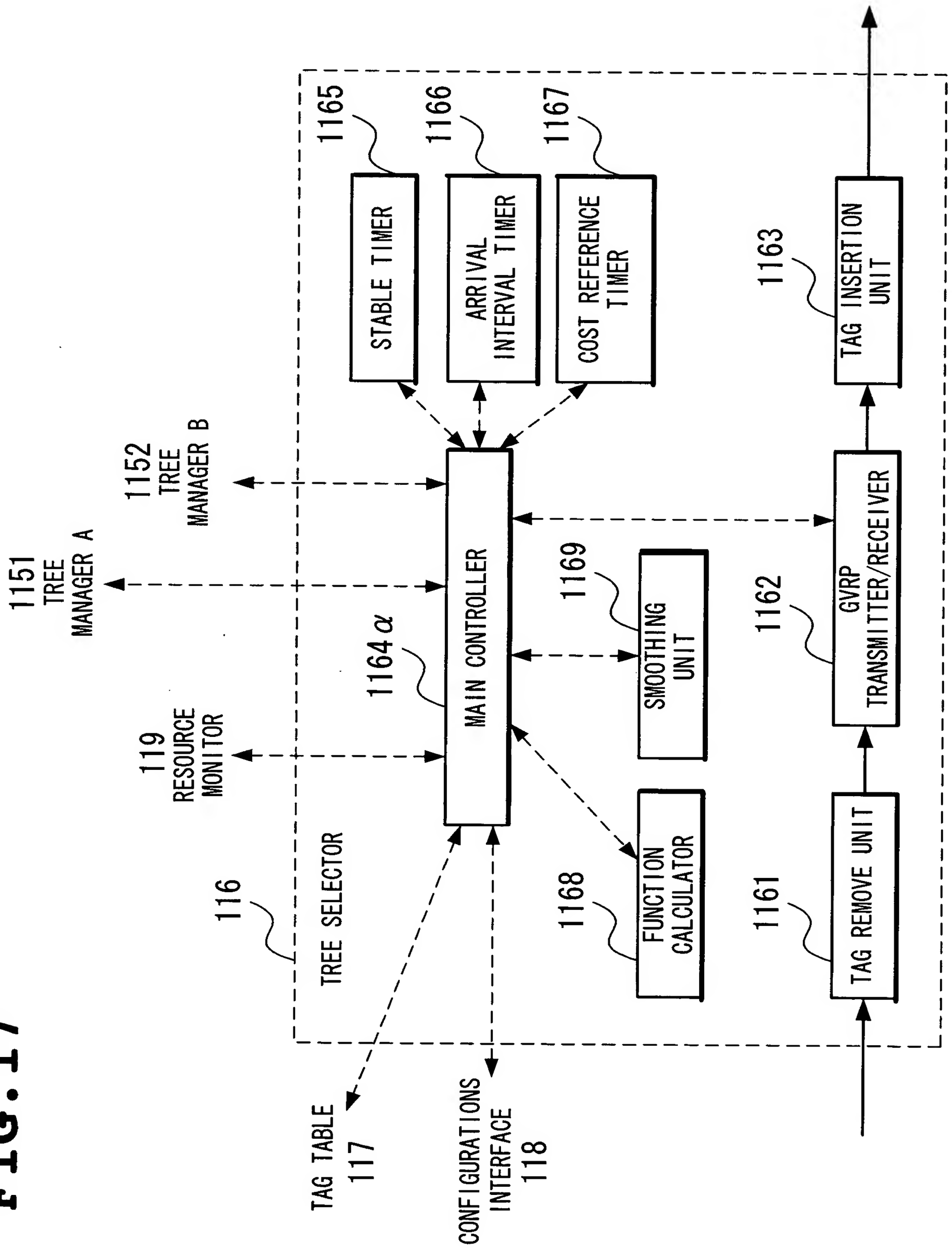
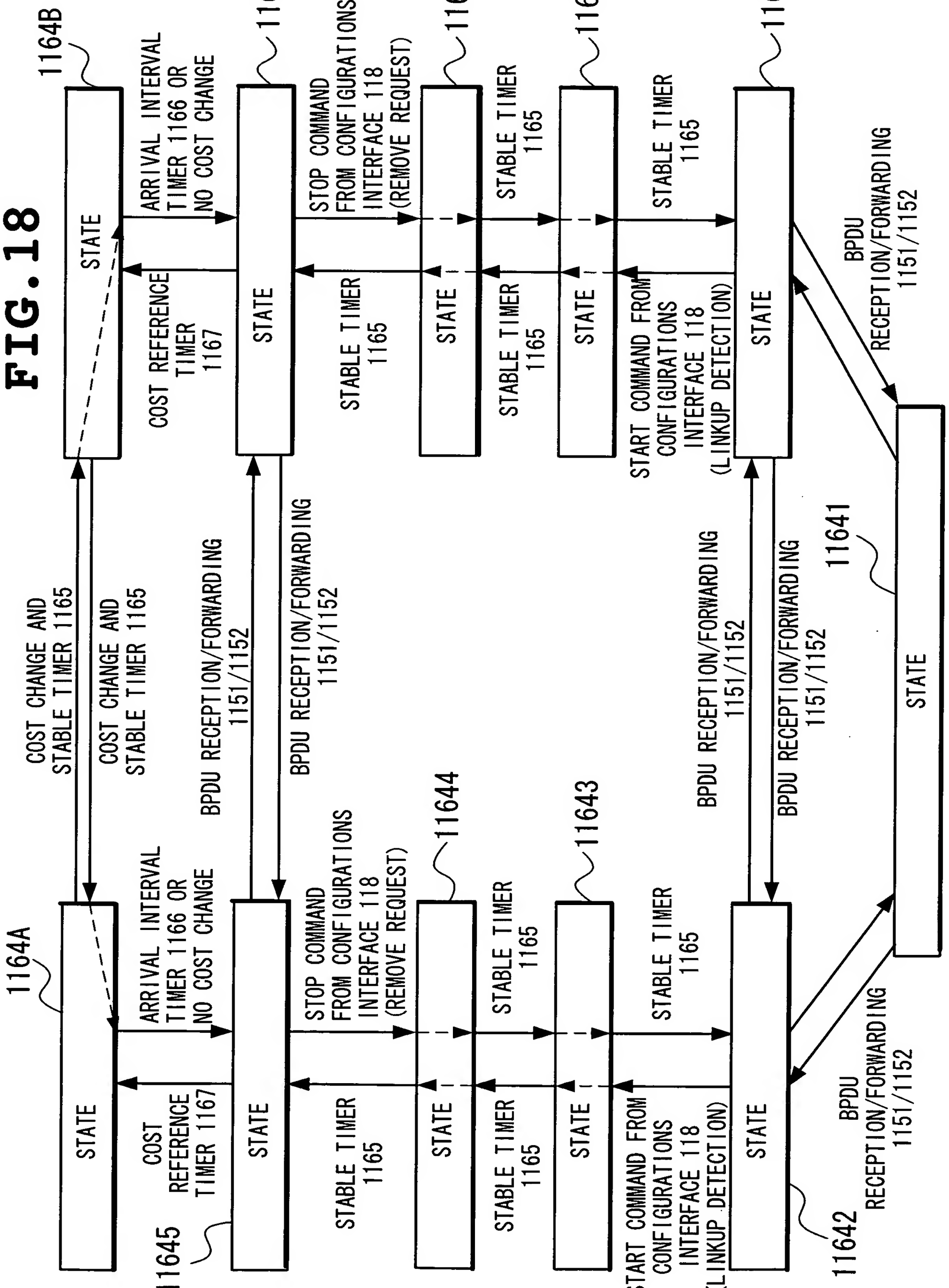

1165
STABLE TIMER
1166
ARRIVAL INTERVAL TIMER
1167
COST REFERENCE TIMER
1163
TAG INSERTION UNIT
1152
TREE MANAGER B
1151
TREE MANAGER A
1164α
MAIN CONTROLLER
1169
SMOOTHING UNIT
1162
GVRP TRANSMITTER/RECEIVER
119
RESOURCE MONITOR
116
TREE SELECTOR
1168
FUNCTION CALCULATOR
1161
TAG REMOVE UNIT
TAG TABLE
117
CONFIGURATIONS INTERFACE
118

FIG.17

FIG. 18


11164B
STATE
ARRIVAL INTERVAL TIMER 1166 OR NO COST CHANGE
11646
STOP COMMAND FROM CONFIGURATIONS INTERFACE 118 (REMOVE REQUEST)
11647
STABLE TIMER 1165
11648
STABLE TIMER 1165
11649
BPDU RECEPTION/FORWARDING 1151/1152
COST CHANGE AND STABLE TIMER 1165
COST REFERENCE TIMER 1167
STATE
STABLE TIMER 1165
STATE
STABLE TIMER 1165
STATE
START COMMAND FROM CONFIGURATIONS INTERFACE 118 (LINKUP DETECTION)
STATE
BPDU RECEPTION/FORWARDING 1151/1152
11641
STATE
11644
11643
11164A
STATE
ARRIVAL INTERVAL TIMER 1166 OR NO COST CHANGE
11645
COST REFERENCE TIMER 1167
STATE
STABLE TIMER 1165
STATE
STABLE TIMER 1165
STATE
START COMMAND FROM CONFIGURATIONS INTERFACE 118 (LINKUP DETECTION)
STATE
11642
BPDU RECEPTION/FORWARDING 1151/1152

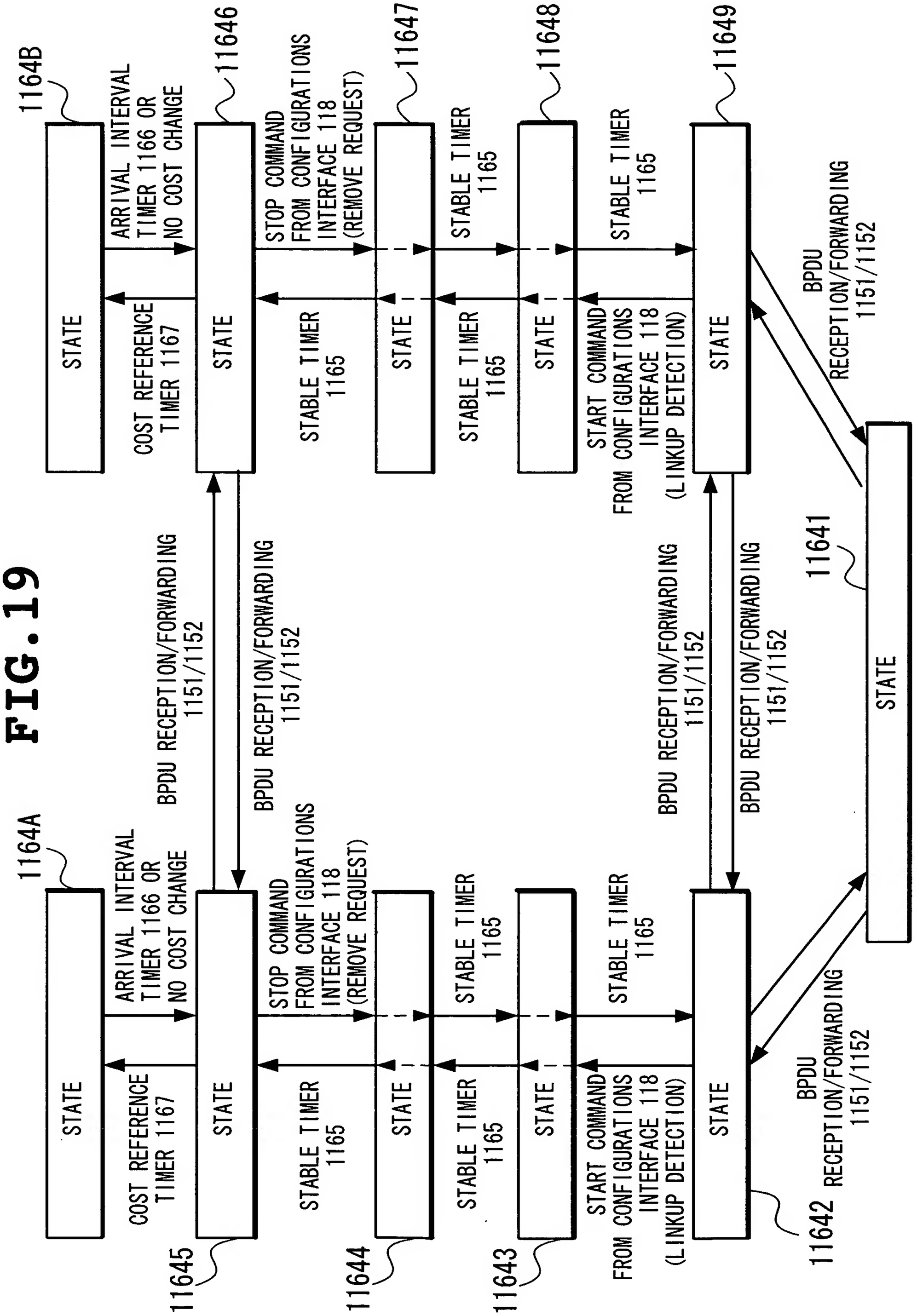

11645
STATE
COST REFERENCE TIMER 1167
ARRIVAL INTERVAL TIMER 1166 OR NO COST CHANGE
11646
STATE
BPDU RECEPTION/FORWARDING 1151/1152
STABLE TIMER 1165
STOP COMMAND FROM CONFIGURATIONS INTERFACE 118 (REMOVE REQUEST)
11647
STATE
STABLE TIMER 1165
11644
STATE
STABLE TIMER 1165
11648
STATE
START COMMAND FROM CONFIGURATIONS INTERFACE 118 (LINKUP DETECTION)
11643
STATE
BPDU RECEPTION/FORWARDING 1151/1152
11649
STATE
BPDU RECEPTION/FORWARDING 1151/1152
11641
STATE
BPDU RECEPTION/FORWARDING 1151/1152
11642
STATE

FIG.19

FIG.20

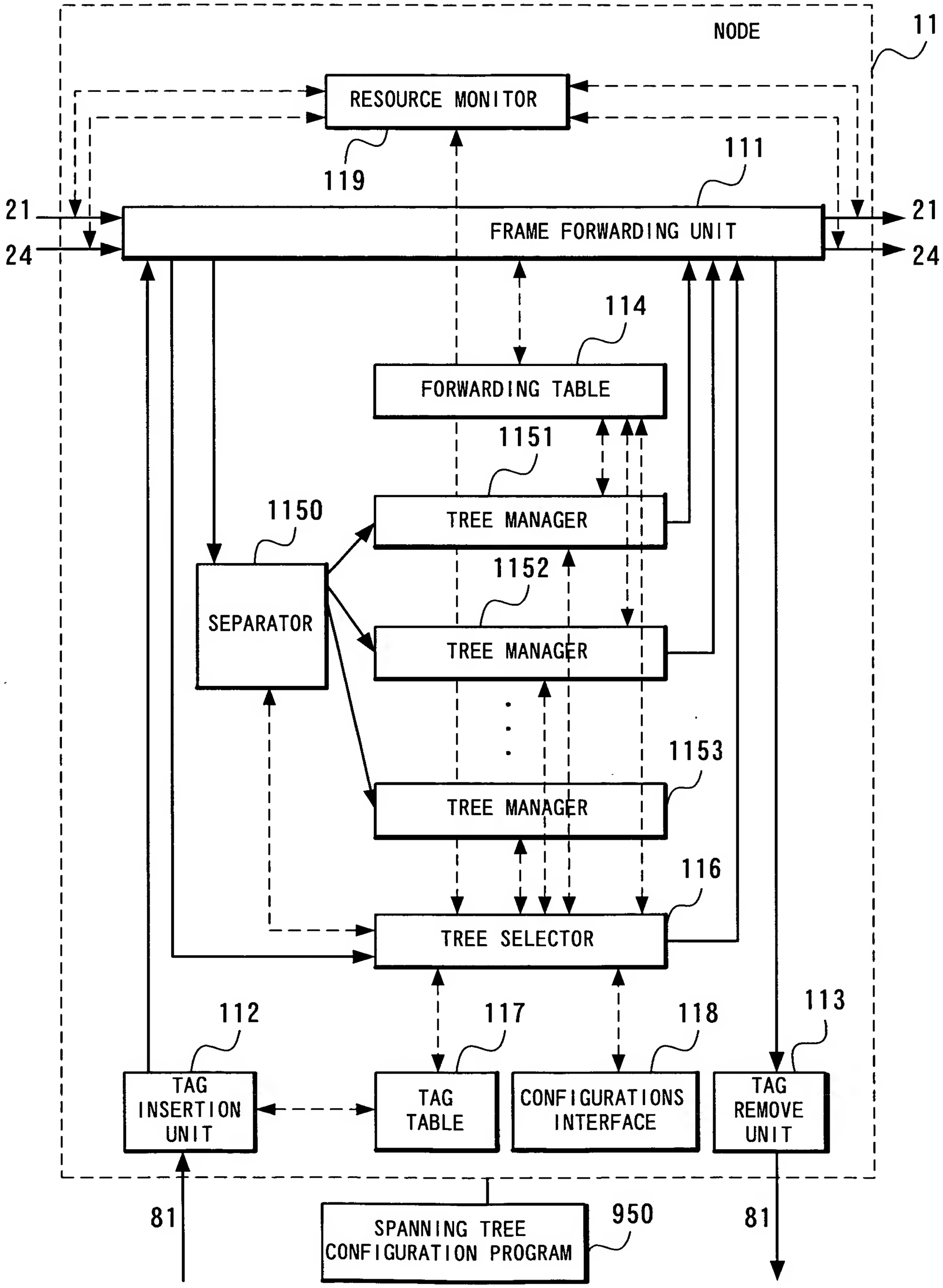

NODE
11
RESOURCE MONITOR
119
111
21
24
FRAME FORWARDING UNIT
21
24
114
FORWARDING TABLE
1151
1150
TREE MANAGER
SEPARATOR
1152
TREE MANAGER
1153
TREE MANAGER
116
TREE SELECTOR
112
117
118
113
TAG INSERTION UNIT
TAG TABLE
CONFIGURATIONS INTERFACE
TAG REMOVE UNIT
81
SPANNING TREE CONFIGURATION PROGRAM
950
81

FIG.21

114

TAG 1141	OUTPUT PORT 1142
41	PORT1
42	PORT2
43	PORT2
44	PORT1

FIG.22

117

DESTINATION MAC ADDRESS 1171	INSERTION TAG 1172
91A	41
91C	41
92B	42
93X	43

FIG.23

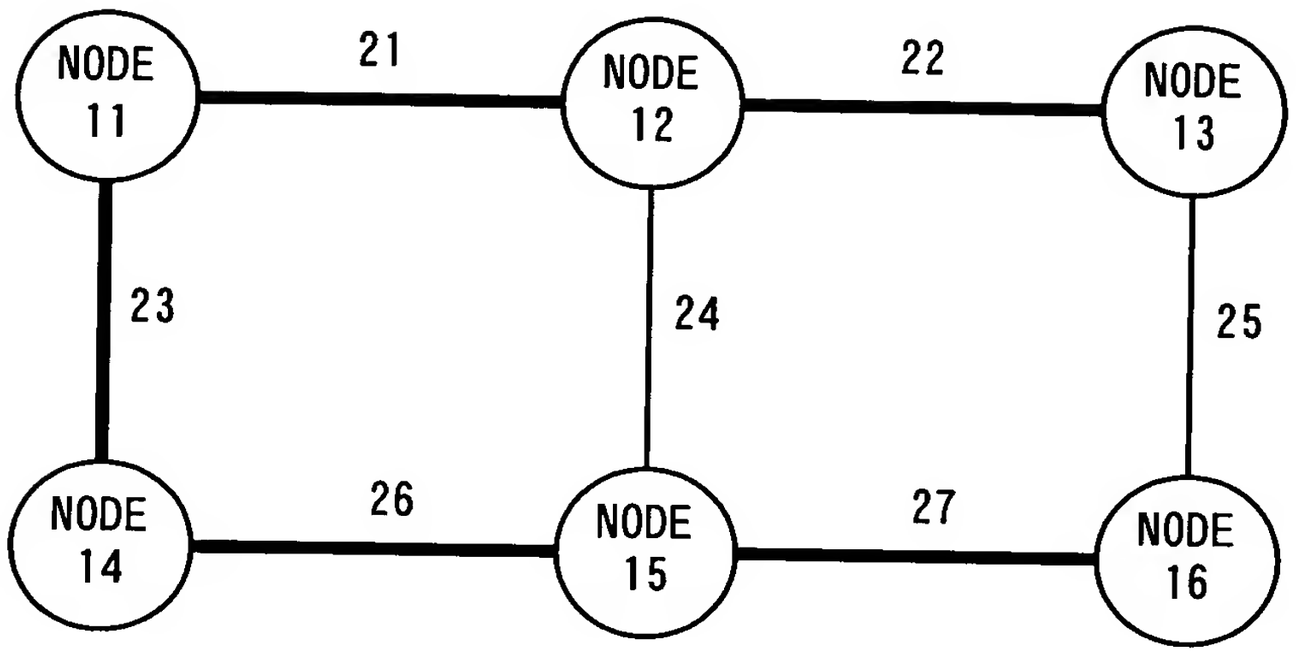


FIG.24

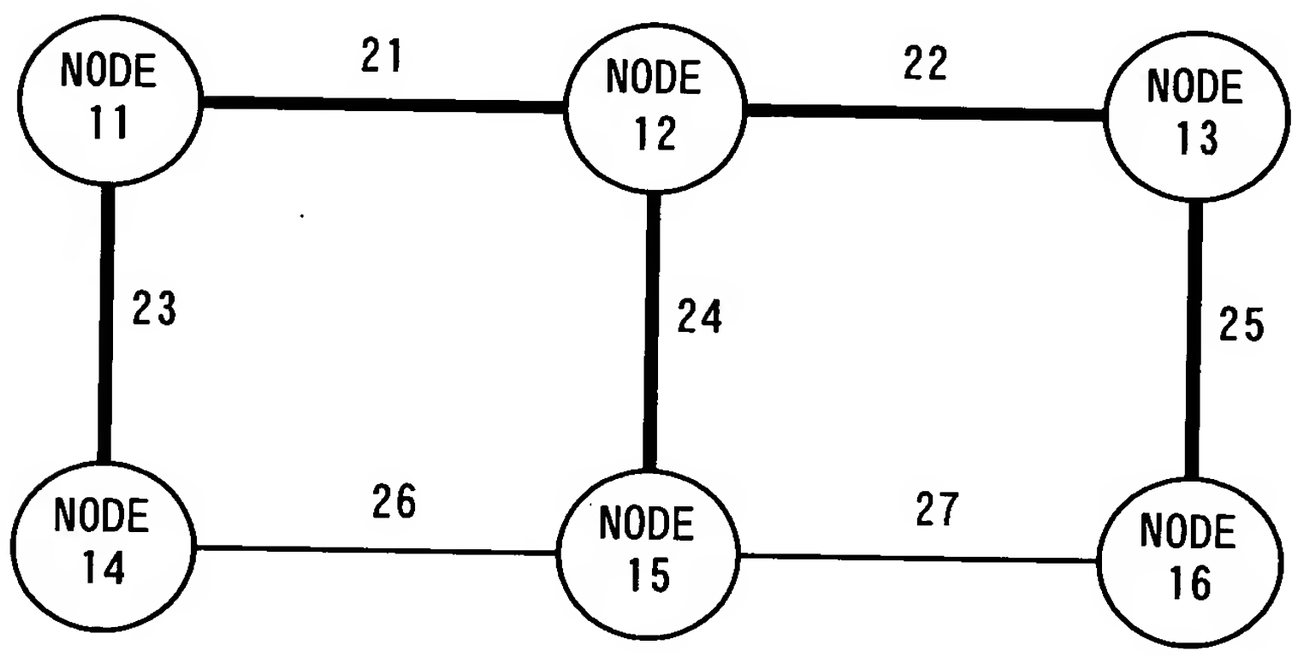


FIG.25

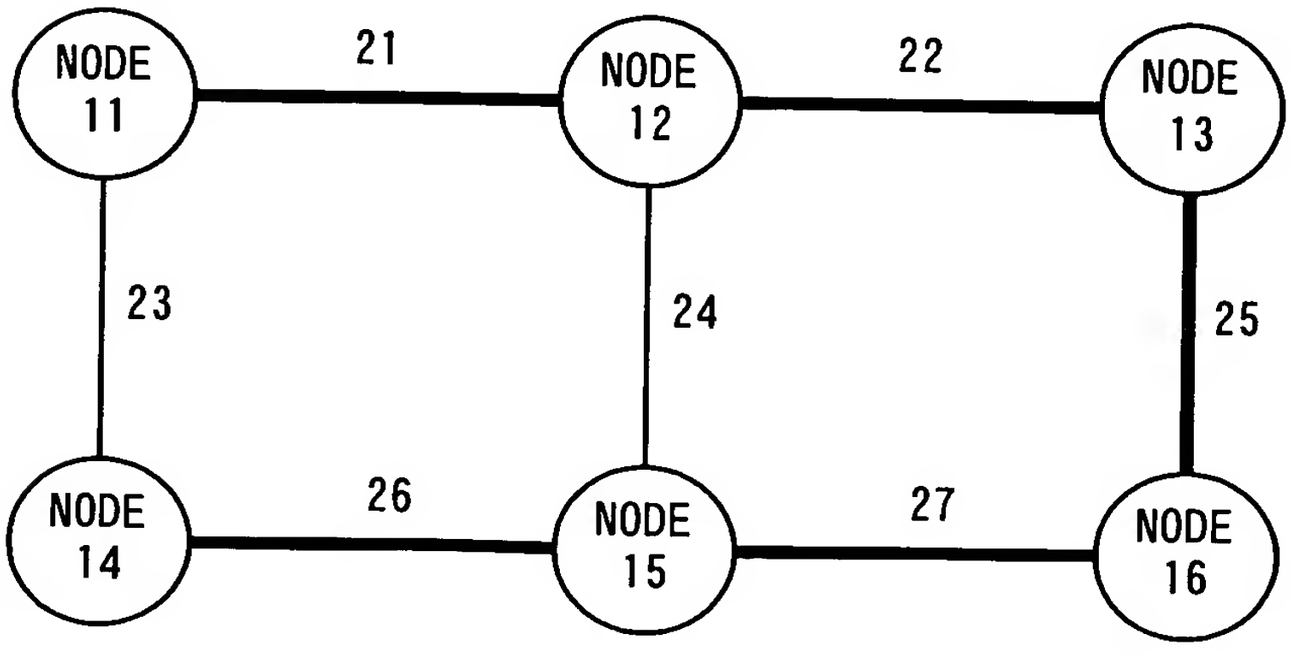


FIG.26

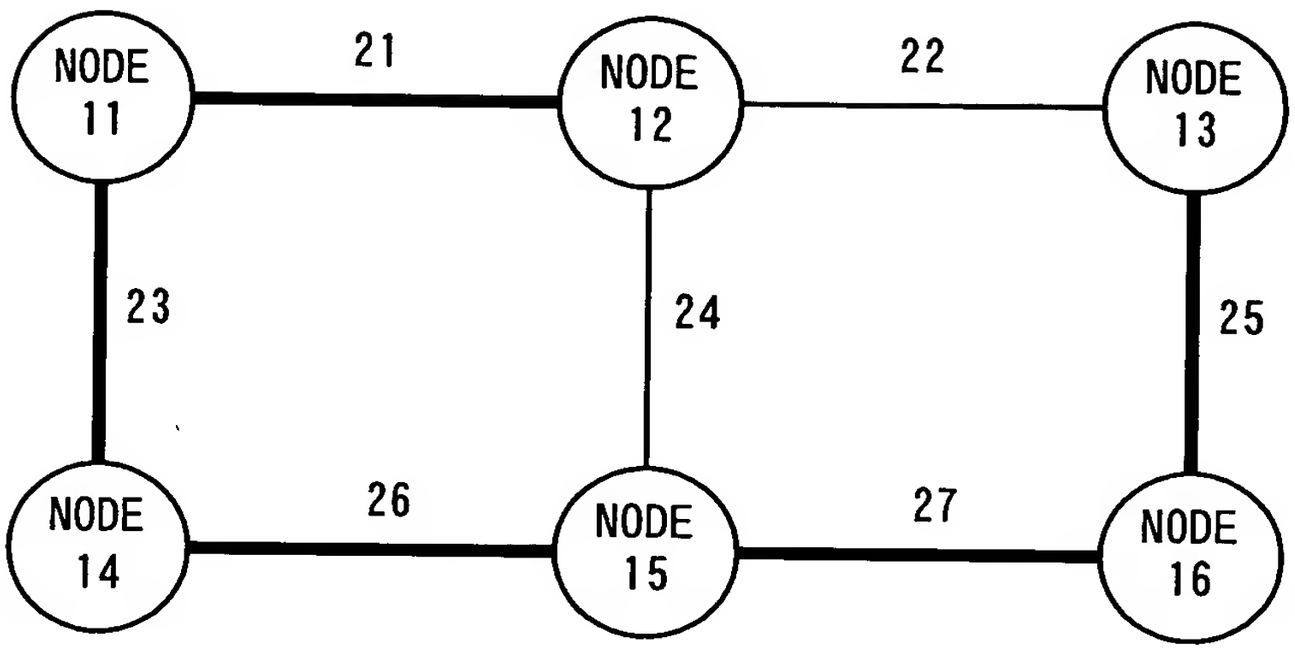


FIG.27

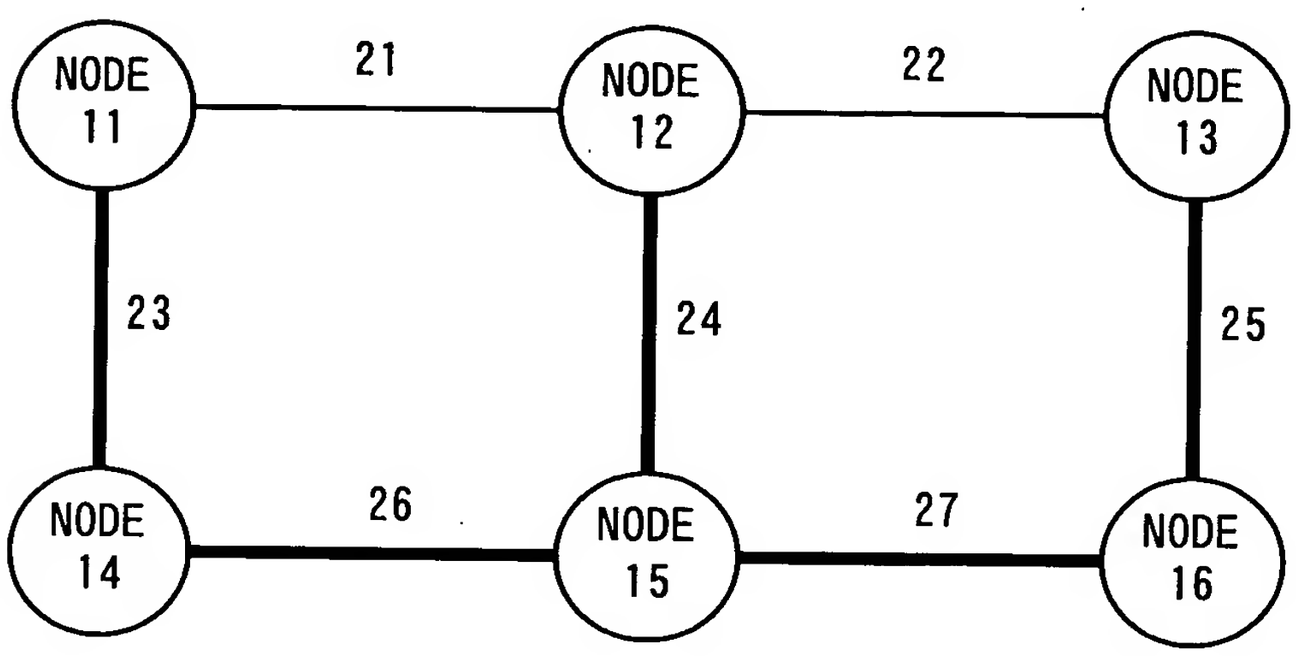


FIG.28

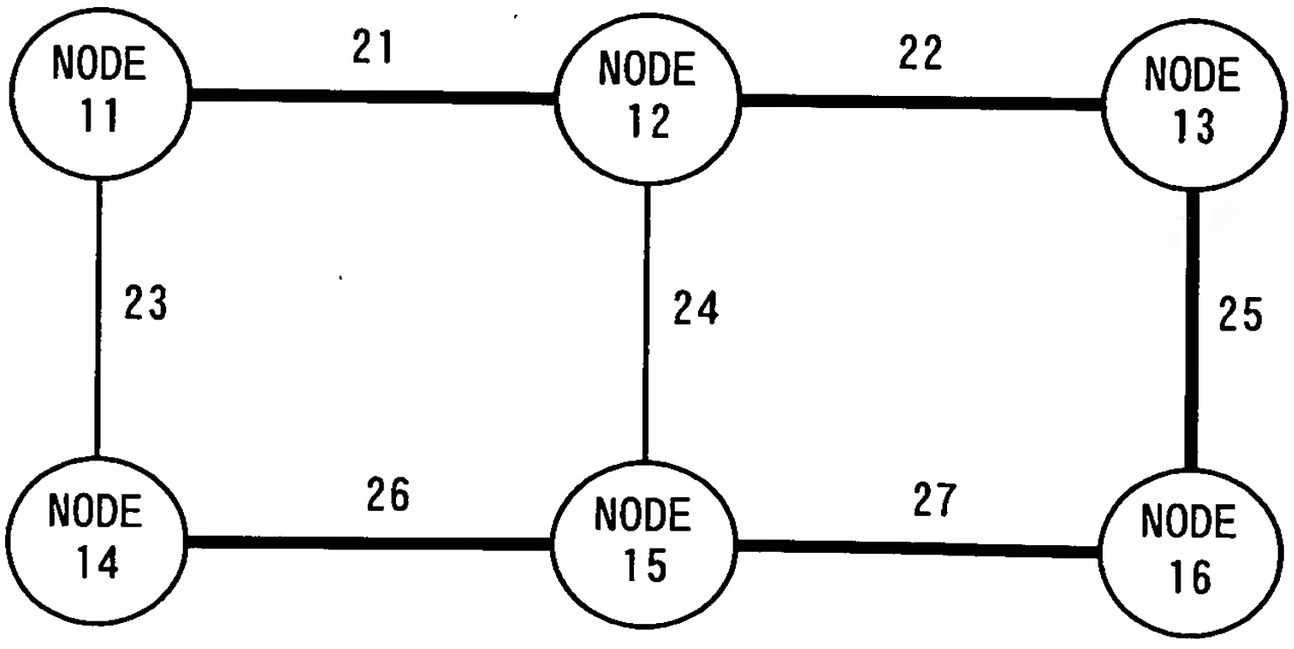


FIG.29

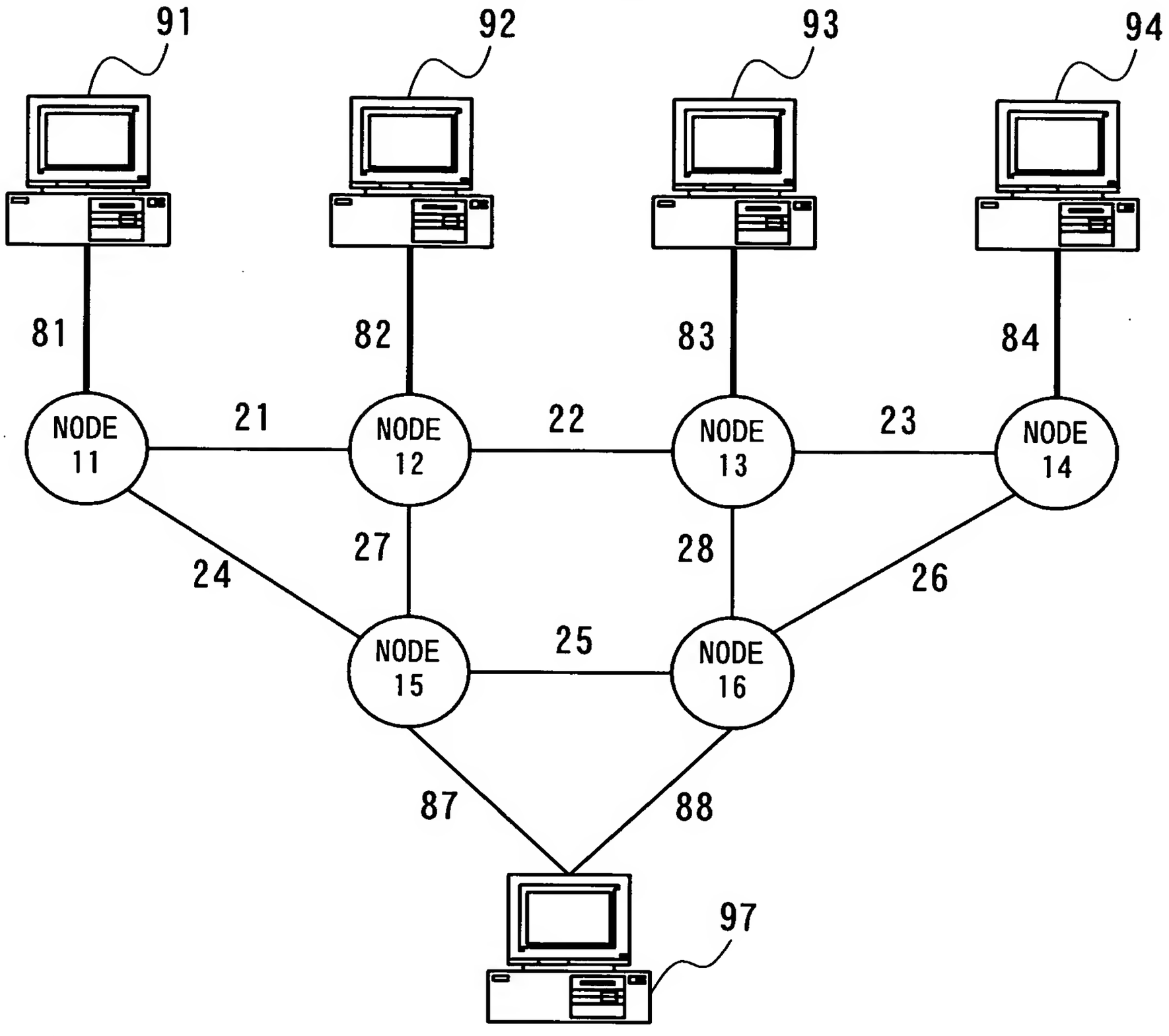

91
92
93
94
81
82
83
84
NODE 11
NODE 12
NODE 13
NODE 14
21
22
23
24
27
28
26
NODE 15
NODE 16
25
87
88
97

FIG.30

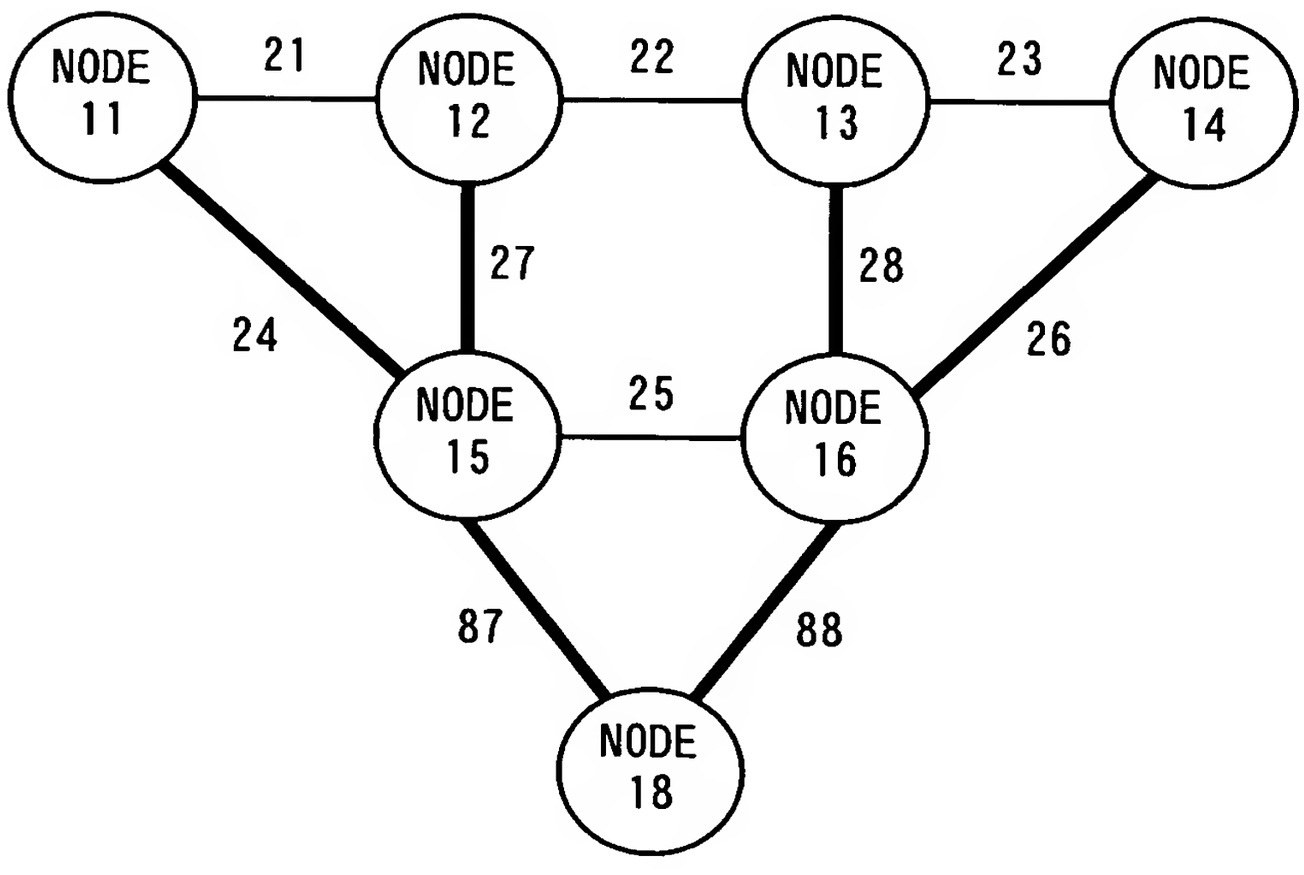

NODE 11
NODE 12
NODE 13
NODE 14
21
22
23
24
27
28
26
NODE 15
NODE 16
25
87
88
NODE 18

FIG.31

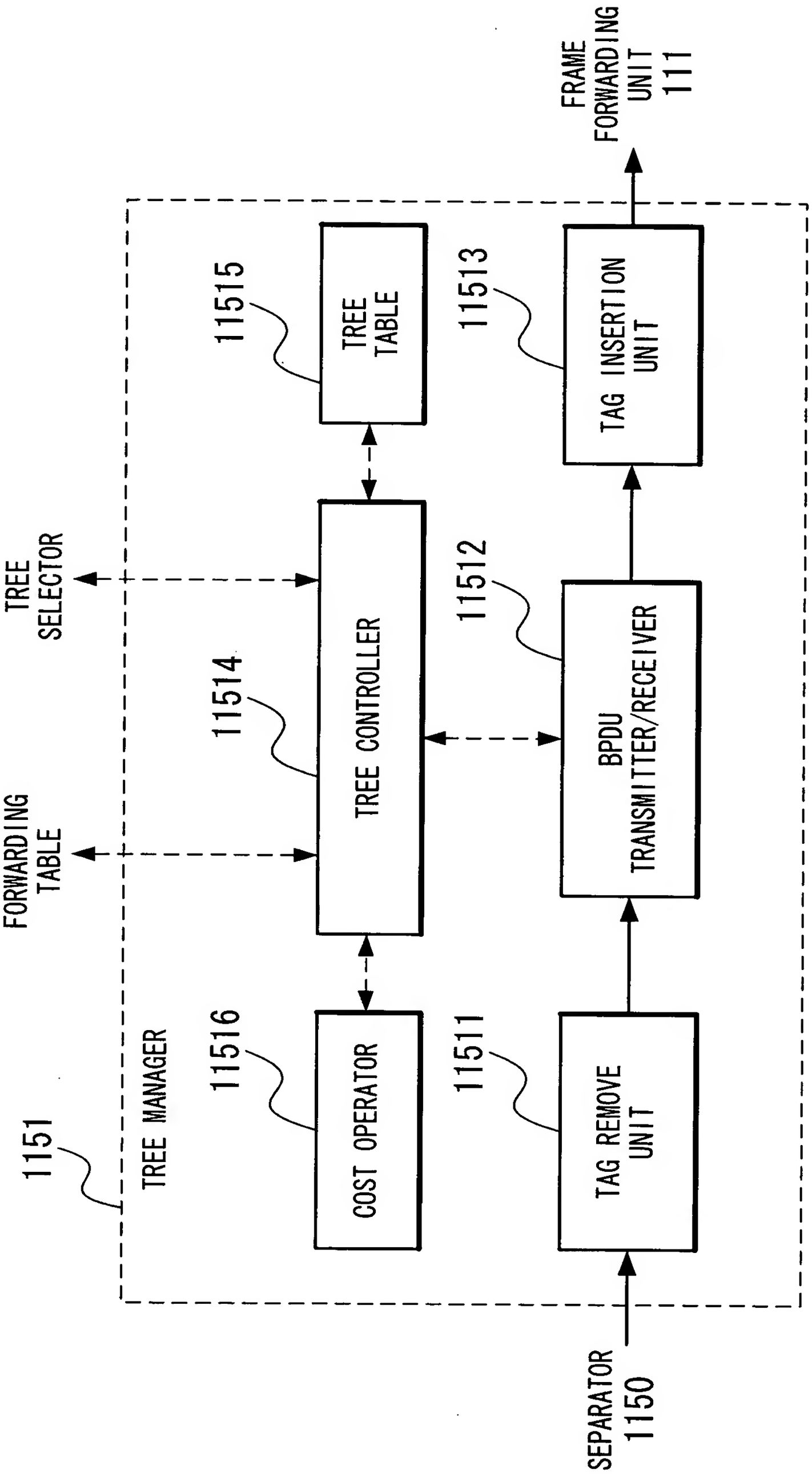

FRAME FORWARDING UNIT 111
11515
TREE TABLE
11513
TAG INSERTION UNIT
116 TREE SELECTOR
11514
TREE CONTROLLER
11512
BPDU TRANSMITTER/RECEIVER
114 FORWARDING TABLE
1151
TREE MANAGER
11516
COST OPERATOR
11511
TAG REMOVE UNIT
SEPARATOR 1150

FIG.32

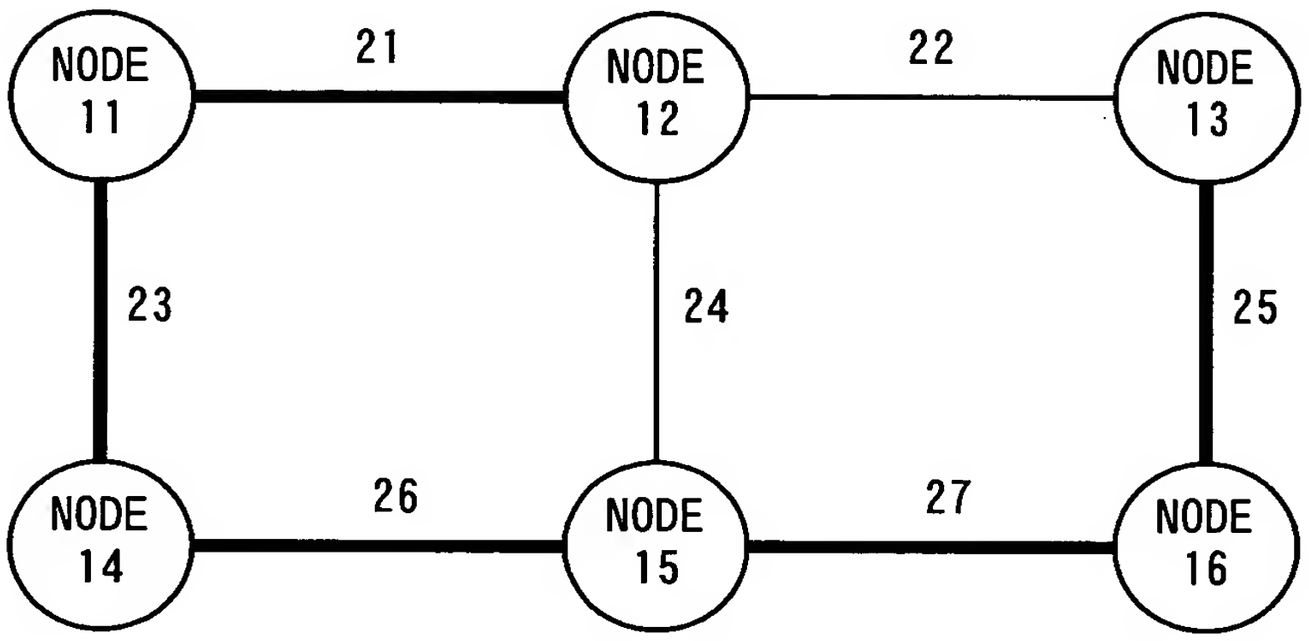


FIG.33

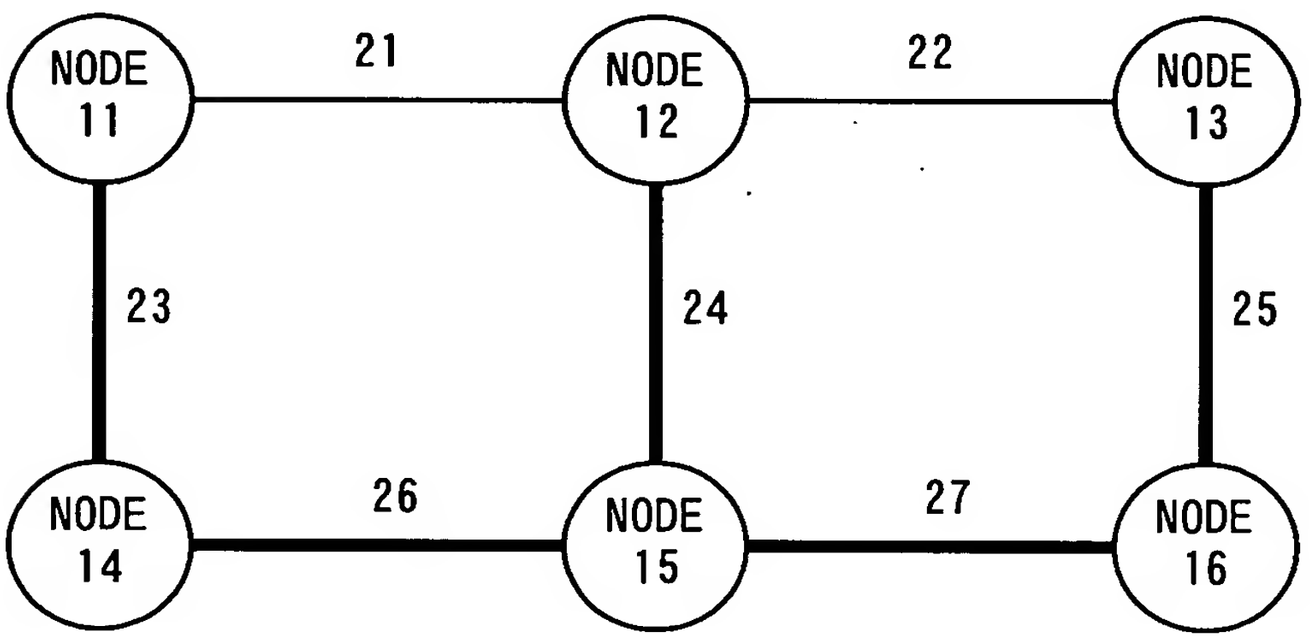


FIG.34

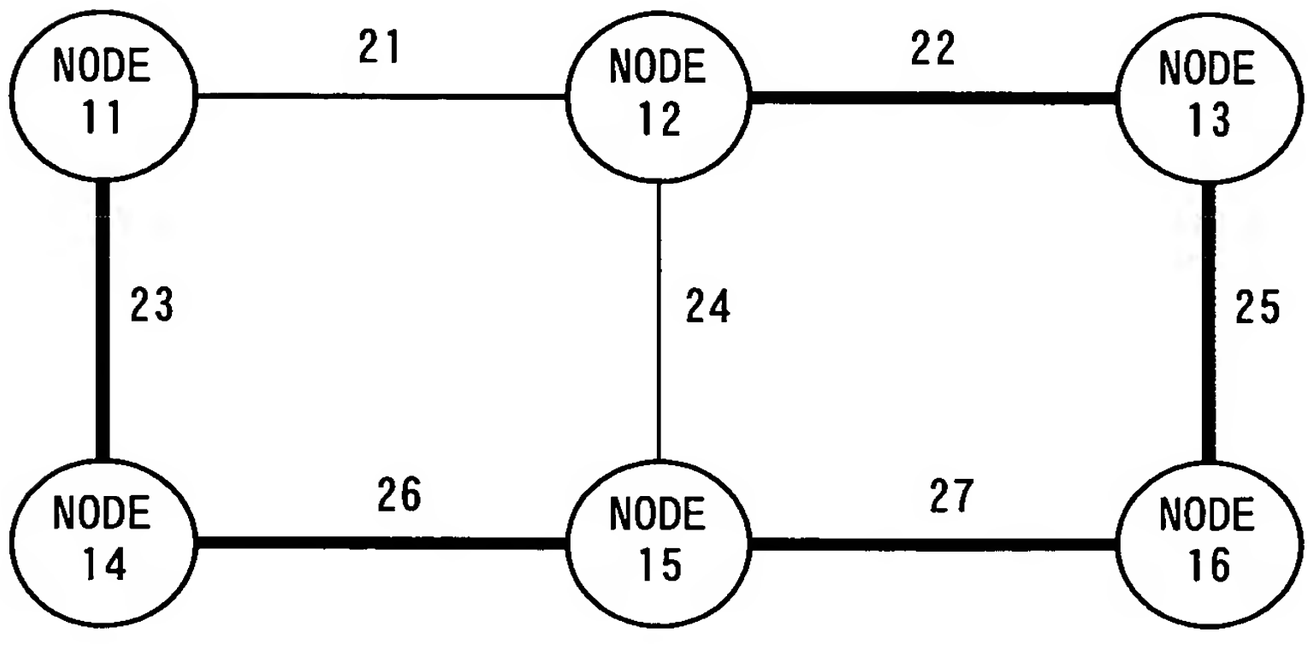


FIG.35

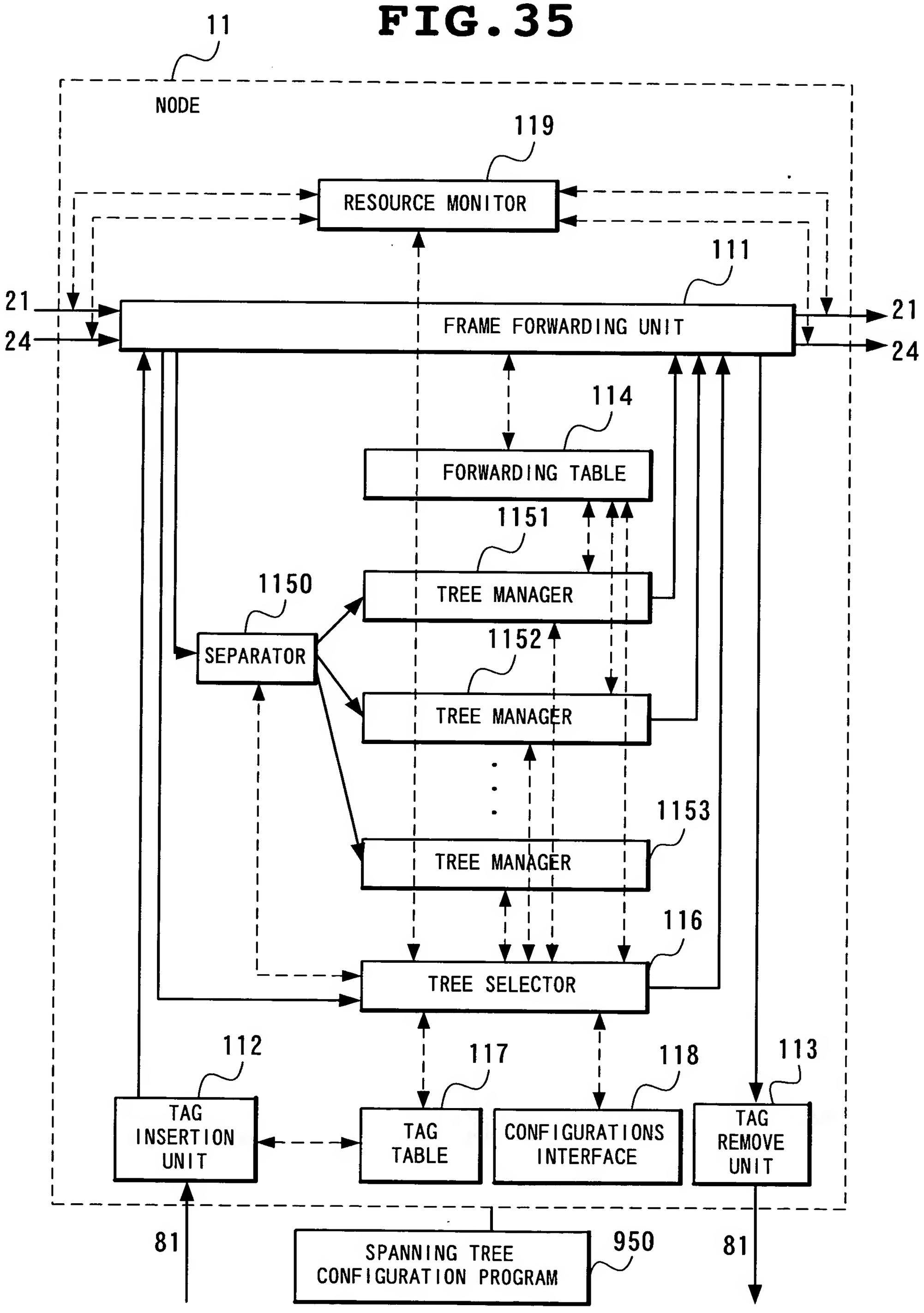

11
NODE
119
RESOURCE MONITOR
111
21
24
FRAME FORWARDING UNIT
21
24
114
FORWARDING TABLE
1151
1150
TREE MANAGER
SEPARATOR
1152
TREE MANAGER
1153
TREE MANAGER
116
TREE SELECTOR
112
117
118
113
TAG INSERTION UNIT
TAG TABLE
CONFIGURATIONS INTERFACE
TAG REMOVE UNIT
81
SPANNING TREE CONFIGURATION PROGRAM
950
81

FIG 36

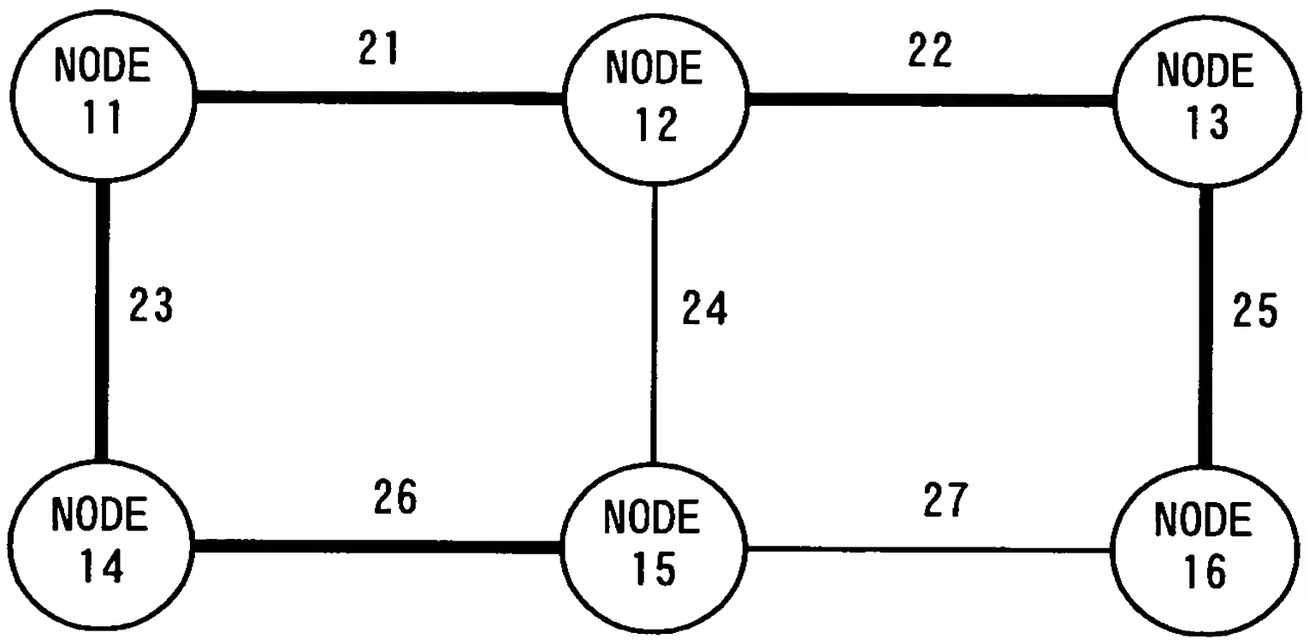


FIG.37

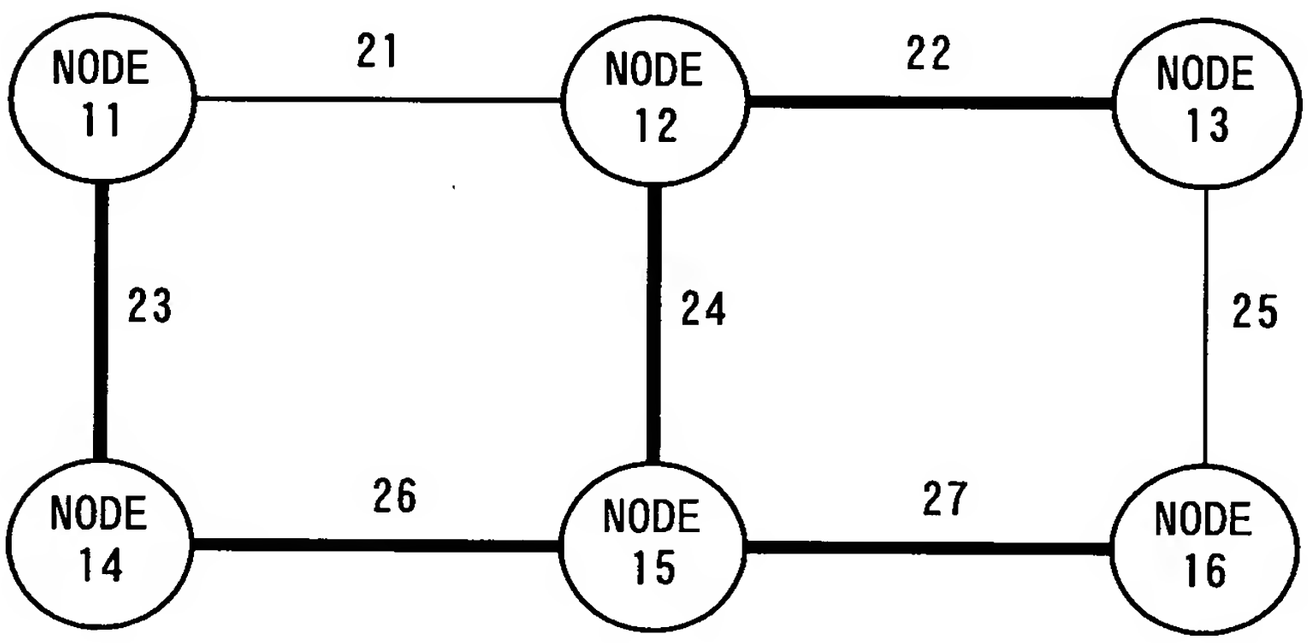


FIG.38

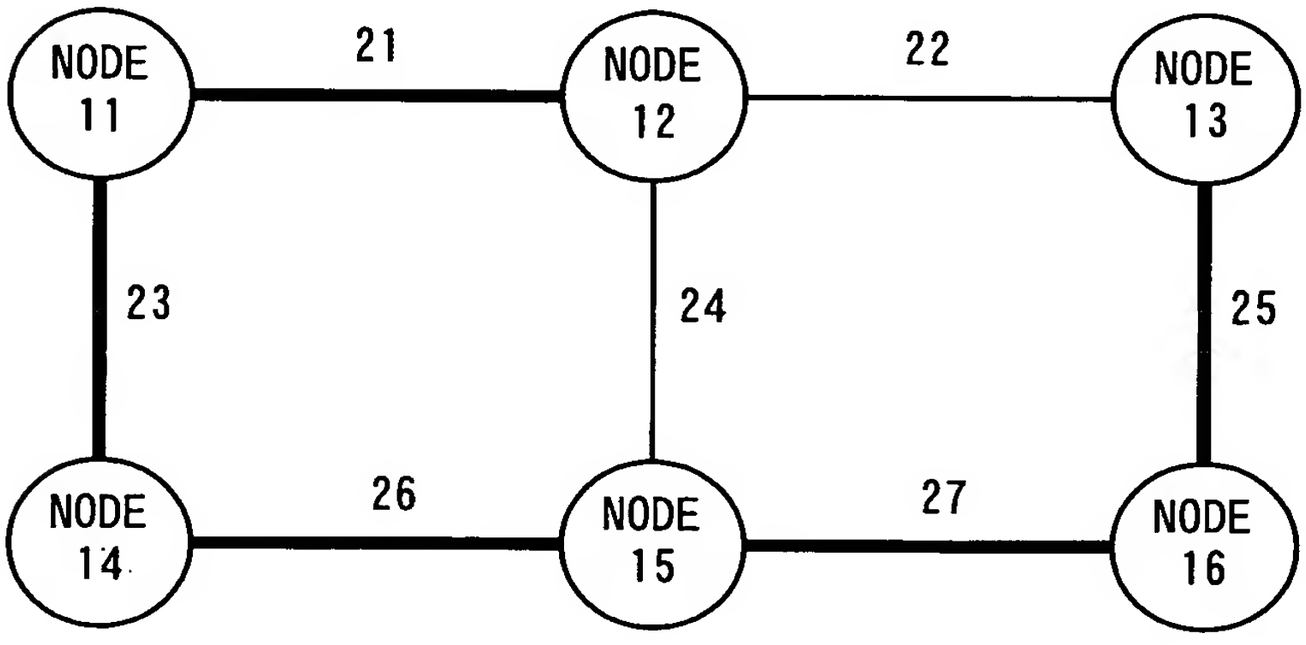


FIG.39

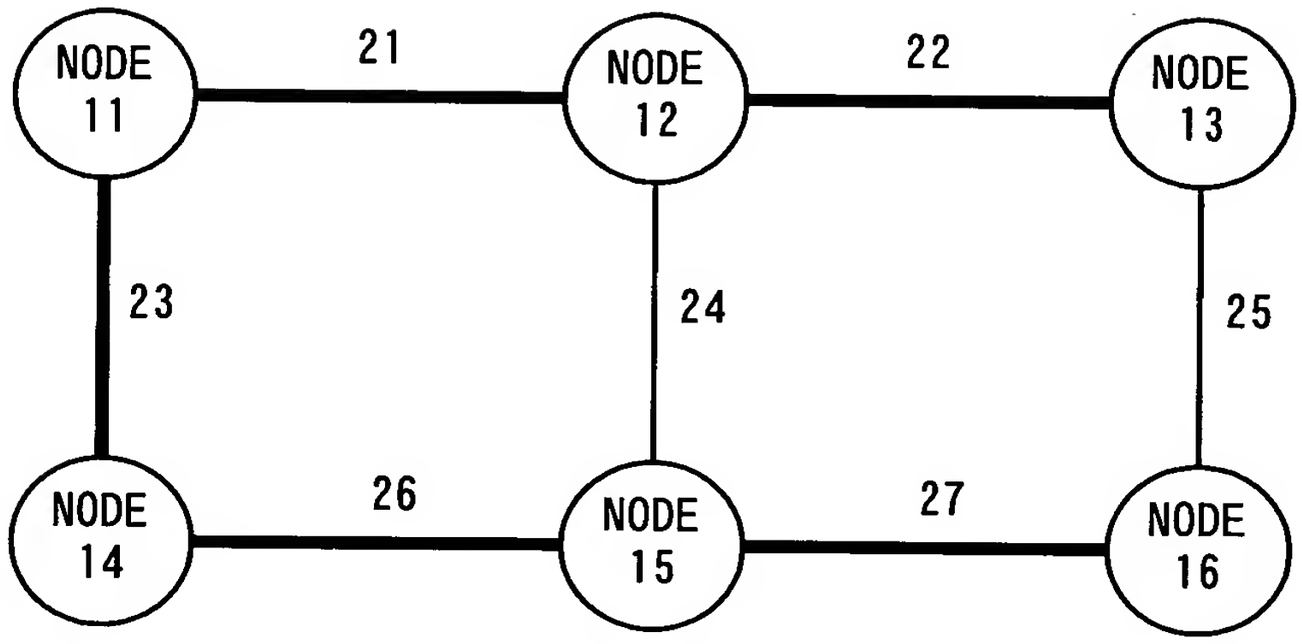

NODE 11
NODE 12
NODE 13
NODE 14
NODE 15
NODE 16
21
22
23
24
25
26
27

FIG.40

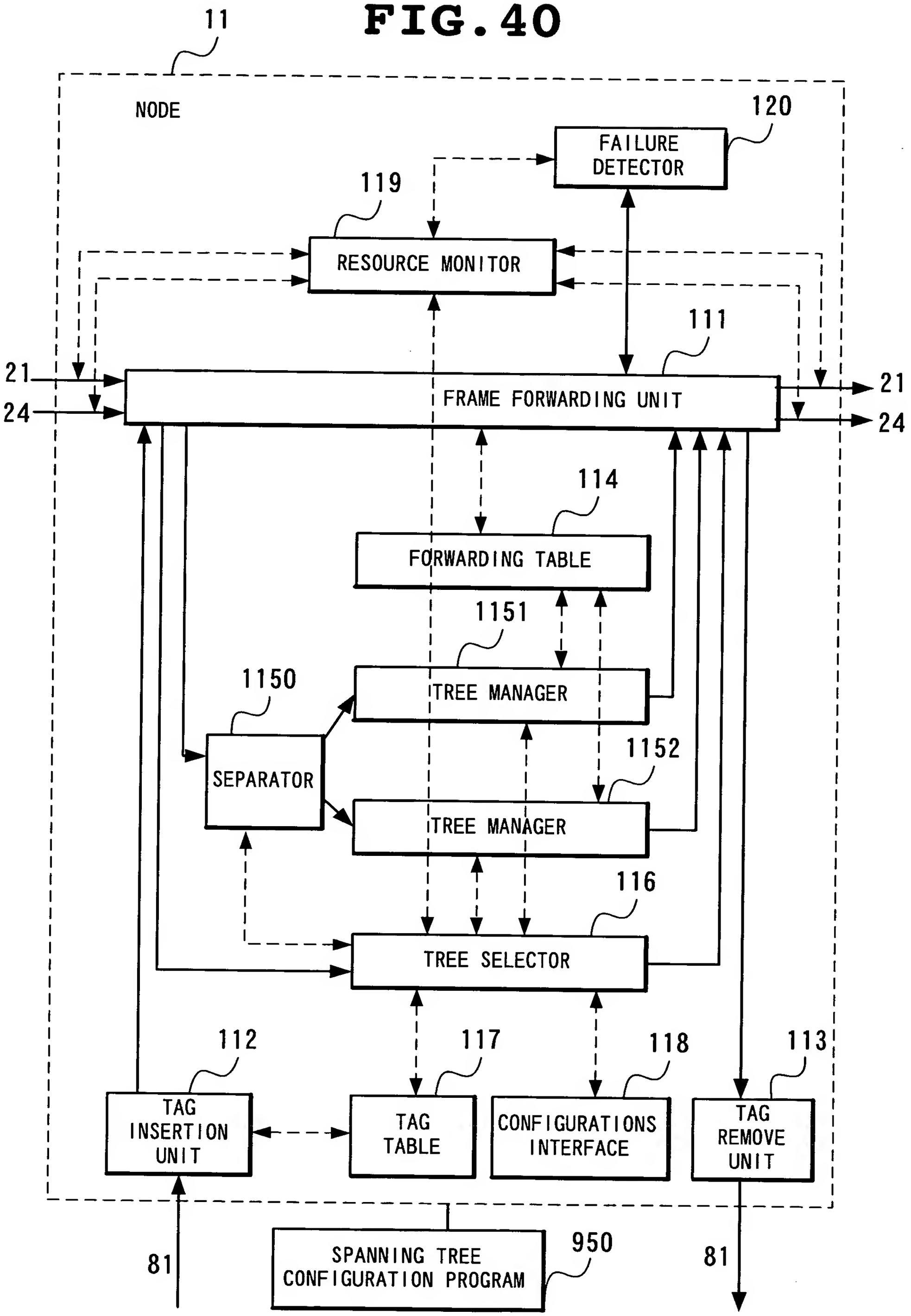

11
NODE
120
FAILURE DETECTOR
119
RESOURCE MONITOR
111
21
24
FRAME FORWARDING UNIT
21
24
114
FORWARDING TABLE
1151
1150
TREE MANAGER
SEPARATOR
1152
TREE MANAGER
116
TREE SELECTOR
112
117
118
113
TAG INSERTION UNIT
TAG TABLE
CONFIGURATIONS INTERFACE
TAG REMOVE UNIT
81
SPANNING TREE CONFIGURATION PROGRAM
950
81

FIG.41

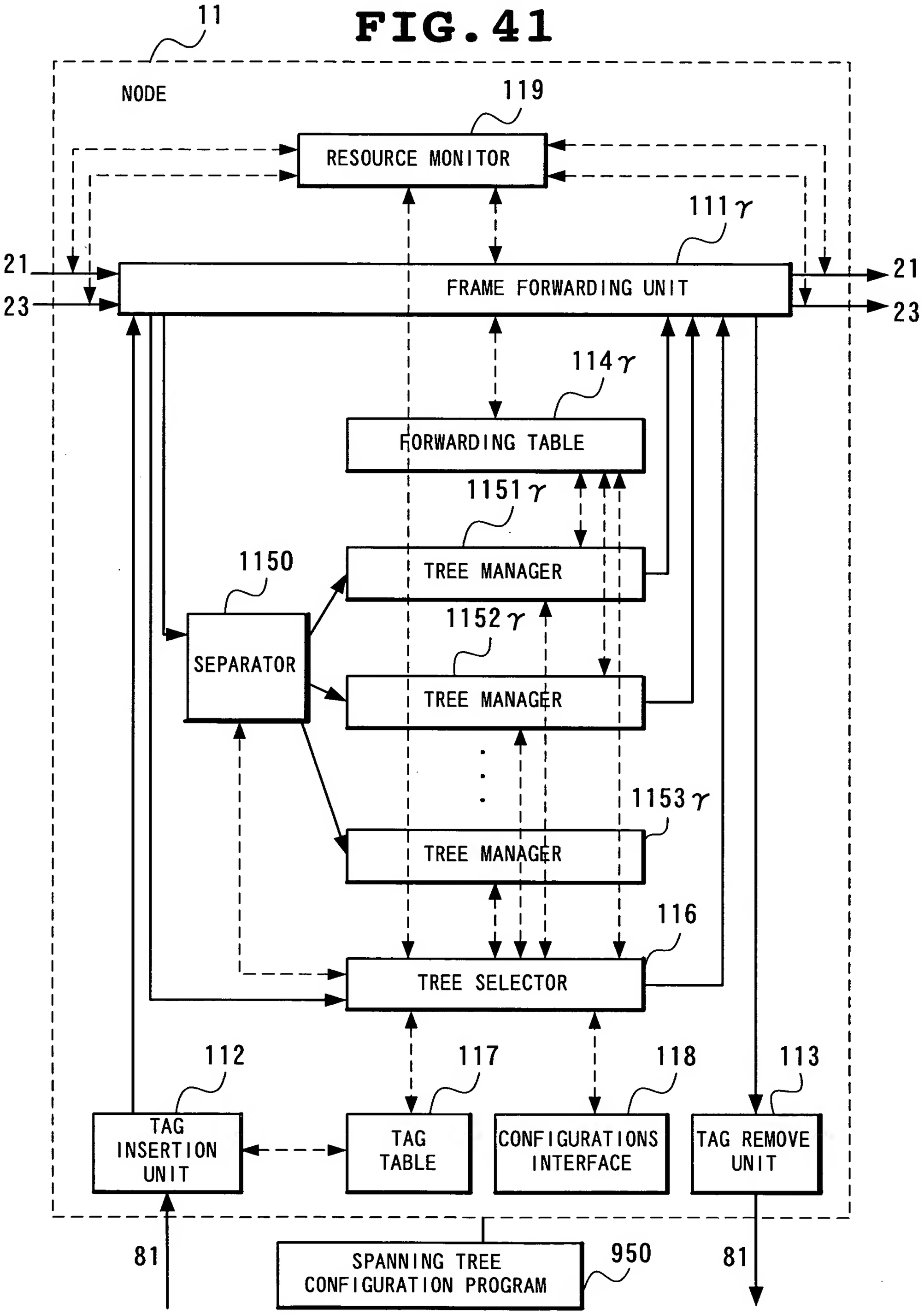

11
NODE
119
RESOURCE MONITOR
111γ
21
23
FRAME FORWARDING UNIT
21
23
114γ
FORWARDING TABLE
1151γ
1150
TREE MANAGER
SEPARATOR
1152γ
TREE MANAGER
1153γ
TREE MANAGER
116
TREE SELECTOR
112
117
118
113
TAG INSERTION UNIT
TAG TABLE
CONFIGURATIONS INTERFACE
TAG REMOVE UNIT
81
SPANNING TREE CONFIGURATION PROGRAM
950
81

FIG 42

114γ

(VIEW FROM NODE 11)

TAG 1141	OUTPUT PORT 1142
41	END
42	LINK 21 SIDE
43	LINK 21 SIDE
44	LINK 23 SIDE
45	LINK 23 SIDE
46	LINK 21 SIDE

FIG.43

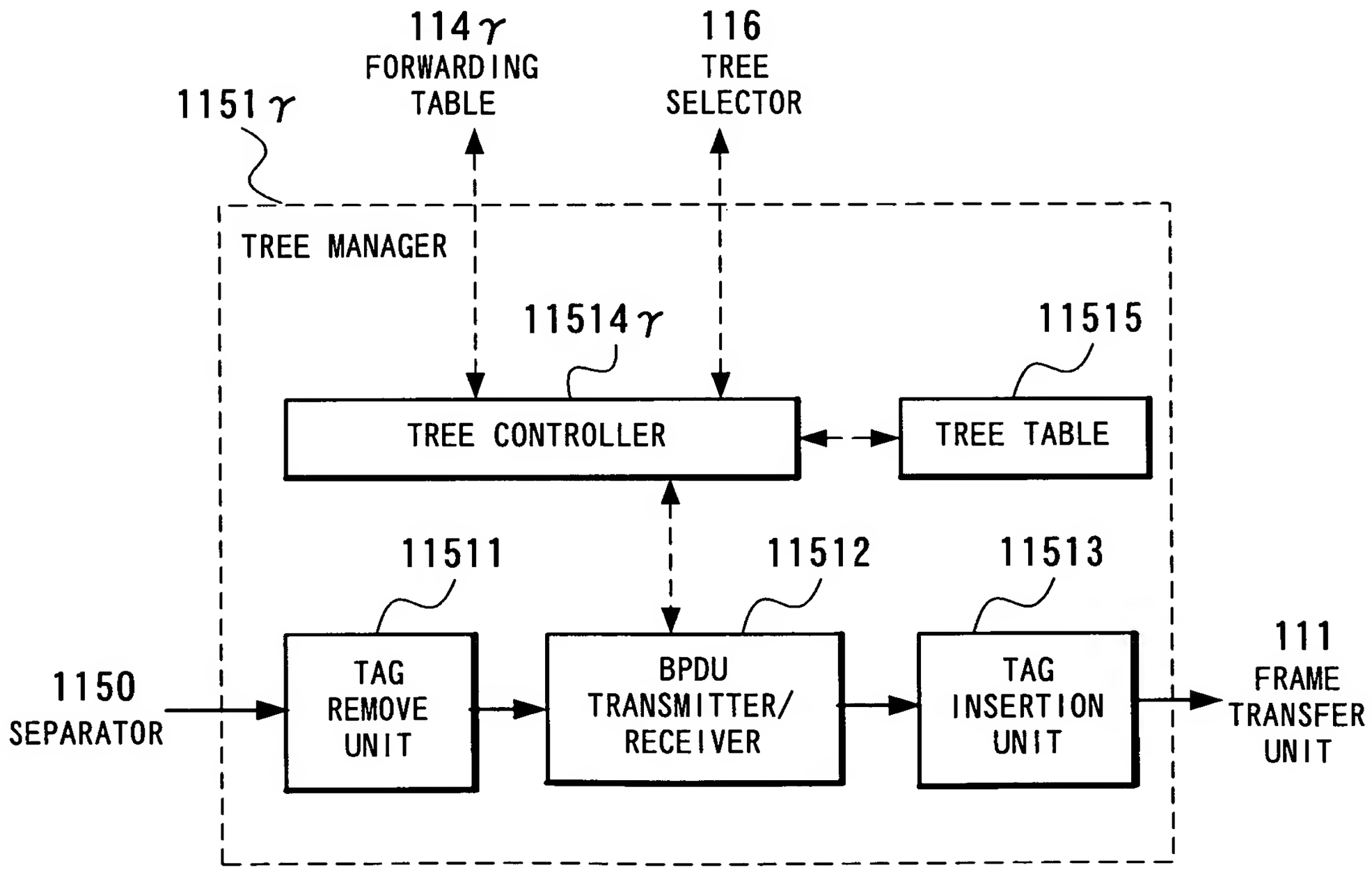


FIG.44

SETTINGS STATUS OF SPANNING TREE 61 (TAG GROUP 41)

NODE 6101	ROOT PORT 6102	TAG 1141	OUTPUT PORT 1142
11	N/A	41	END
12	LINK 21 SIDE	41	LINK 21 SIDE
13	LINK 22 SIDE	41	LINK 22 SIDE
14	LINK 23 SIDE	41	LINK 23 SIDE
15	LINK 26 SIDE	41	LINK 26 SIDE
16	LINK 27 SIDE	41	LINK 21 SIDE

FIG 45

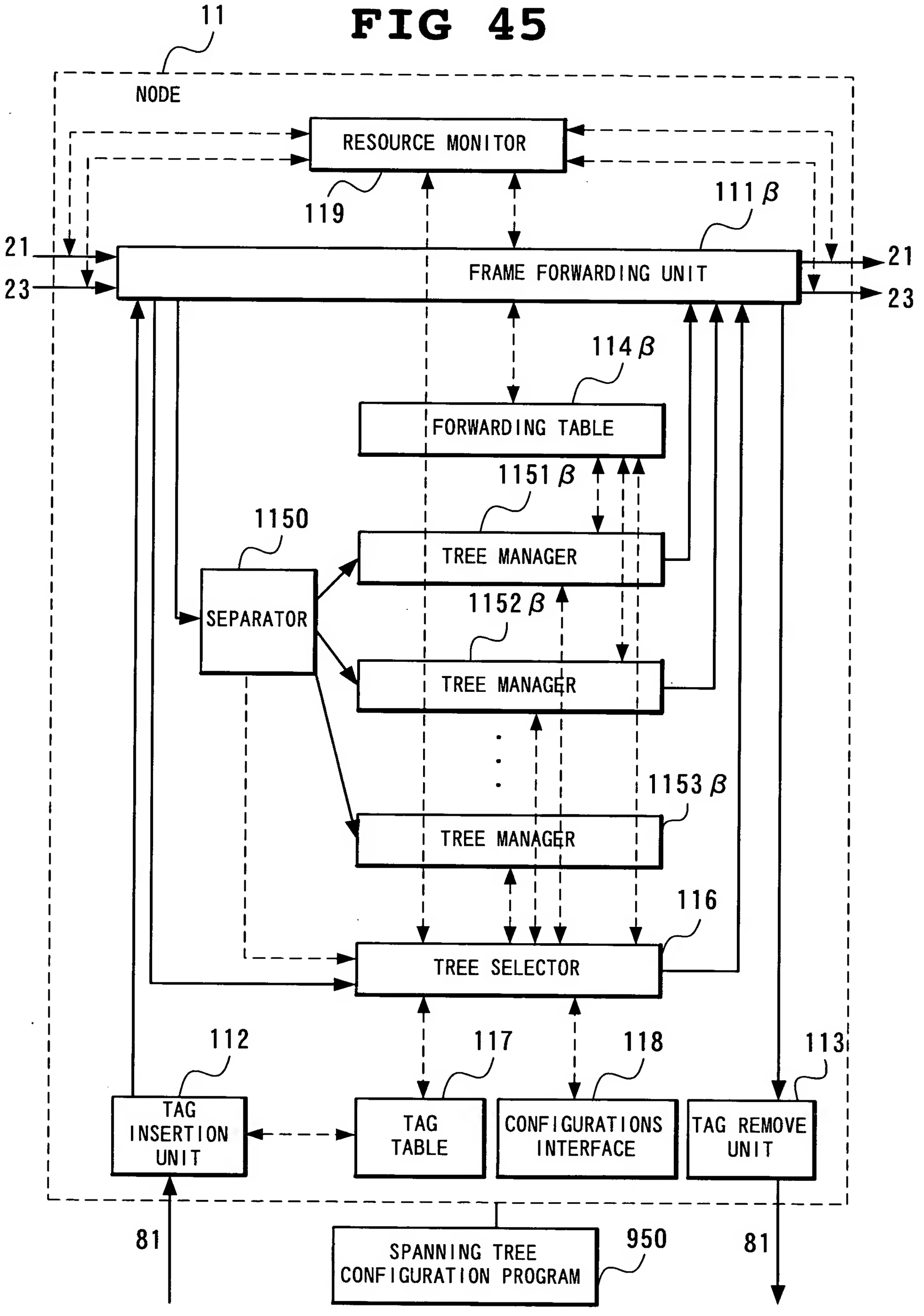

11
NODE
RESOURCE MONITOR
119
111β
21
23
FRAME FORWARDING UNIT
21
23
114β
FORWARDING TABLE
1151β
1150
TREE MANAGER
SEPARATOR
1152β
TREE MANAGER
1153β
TREE MANAGER
116
TREE SELECTOR
112
117
118
113
TAG INSERTION UNIT
TAG TABLE
CONFIGURATIONS INTERFACE
TAG REMOVE UNIT
81
SPANNING TREE CONFIGURATION PROGRAM
950
81

FIG.46

114β

(VIEW FROM NODE 11)

TAG 1141	OUTPUT PORT 1142	BROADCAST OUTPUT PORT 1144
41	TAG REMOVE UNIT SIDE (END)	LINK 21 SIDE, LINK 23 SIDE (END)
42	LINK 21 SIDE	LINK 23 SIDE (END)
43	LINK 21 SIDE	— (END)
44	LINK 23 SIDE	LINK 21 SIDE (END)
45	LINK 23 SIDE	— (END)
46	LINK 21 SIDE	— (END)

FIG.47

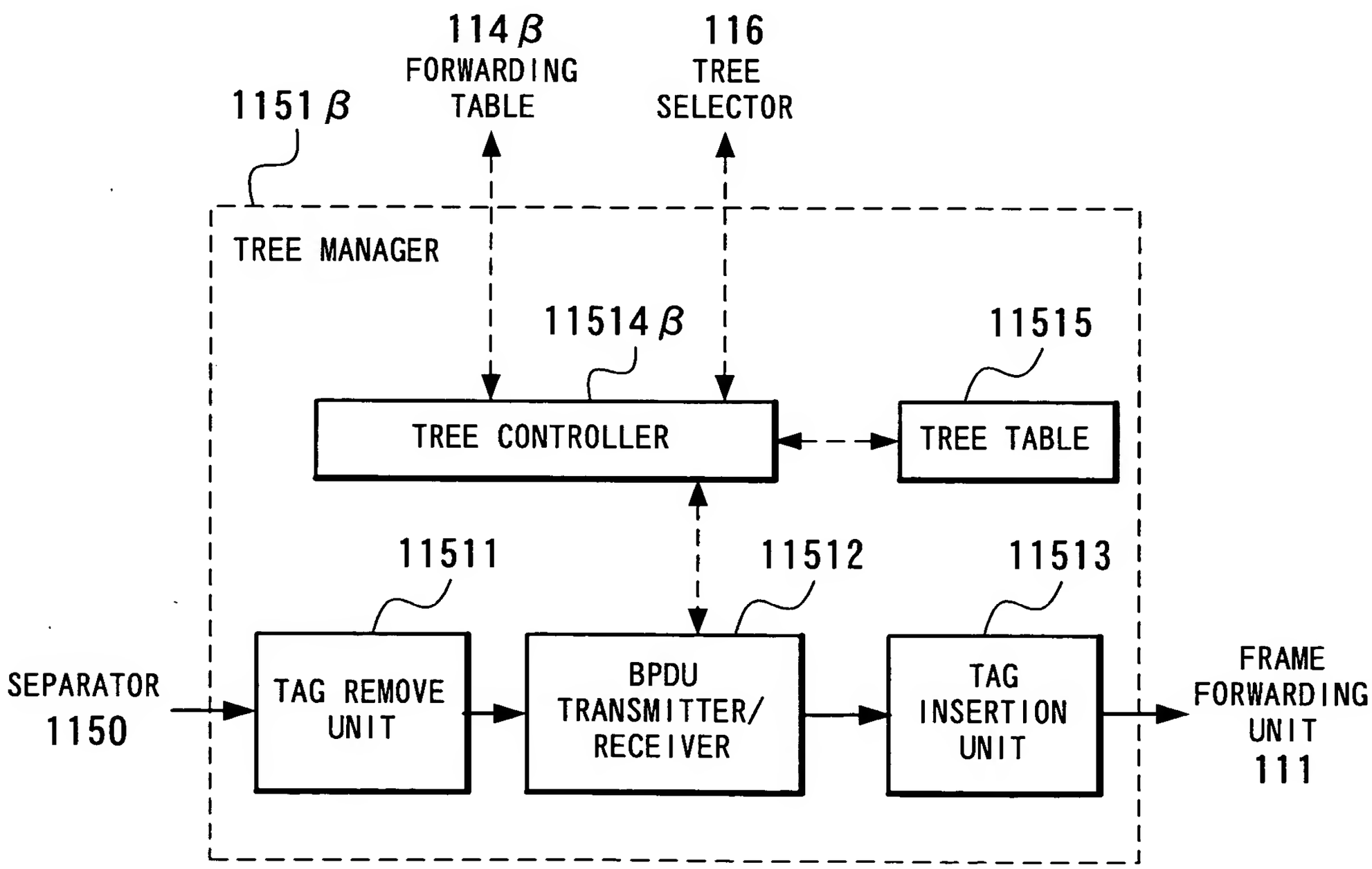


FIG.48

SETTINGS STATUS OF SPANNING TREE 61 (TAG GROUP 41)

NODE 6101	ROOT PORT 6102	DESIGNATED PORT 6104	TAG 1141	OUTPUT PORT 1142	BROADCAST OUTPUT PORT 1144
11	N/A	LINK 21 SIDE、LINK 23 SIDE	41	TAG REMOVE UNIT SIDE	LINK 21 SIDE、LINK 23 SIDE
12	LINK 21 SIDE	LINK 22 SIDE	41	LINK 21 SIDE	LINK 22 SIDE
13	LINK 22 SIDE	N/A	41	LINK 22 SIDE	—
14	LINK 23 SIDE	LINK 26 SIDE	41	LINK 23 SIDE	LINK 26 SIDE
15	LINK 26 SIDE	LINK 27 SIDE	41	LINK 26 SIDE	LINK 27 SIDE
16	LINK 27 SIDE	N/A	41	LINK 27 SIDE	—

FIG 49

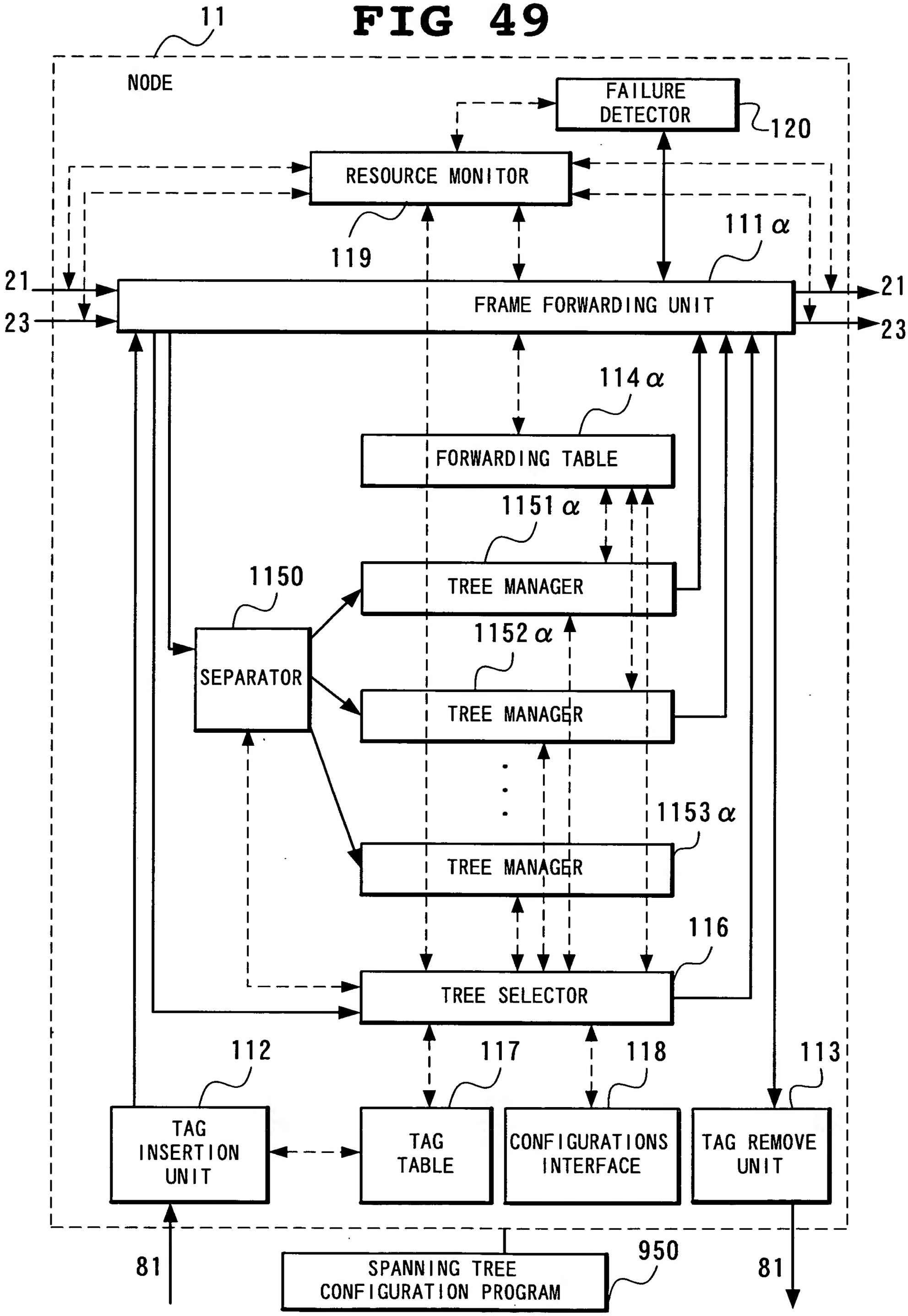

11
NODE
FAILURE DETECTOR
120
RESOURCE MONITOR
119
111α
21
23
FRAME FORWARDING UNIT
21
23
114α
FORWARDING TABLE
1151α
1150
TREE MANAGER
SEPARATOR
1152α
TREE MANAGER
1153α
TREE MANAGER
116
TREE SELECTOR
112
117
118
113
TAG INSERTION UNIT
TAG TABLE
CONFIGURATIONS INTERFACE
TAG REMOVE UNIT
81
950
SPANNING TREE CONFIGURATION PROGRAM
81

FIG.50

114α

(VIEW FROM NODE 12)

TAG1141	ROOT PORT 1142	AUXILIARY OUTPUT PORT 1143
41	LINK 21 SIDE	LINK 24 SIDE
42	END	END
43	LINK 22 SIDE	LINK 24 SIDE
44	LINK 21 SIDE	LINK 24 SIDE
45	LINK 24 SIDE	LINK 21 SIDE (OR 22)
46	LINK 22 SIDE	LINK 24 SIDE

FIG.51

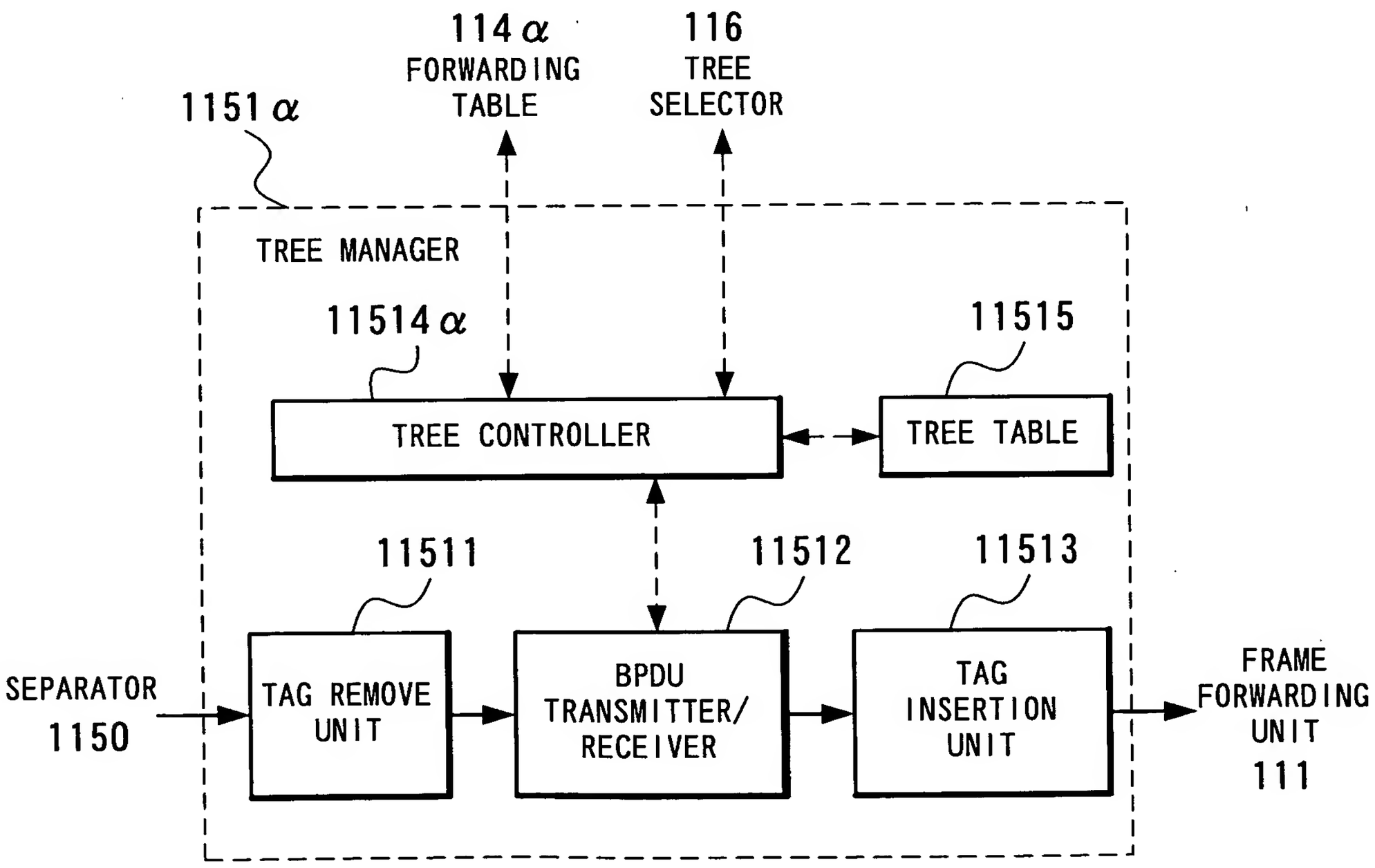


FIG.52

SETTINGS STATUS OF SPANNING TREE 61 (TAG GROUP 41)

NODE 6101	ROOT PORT 6102	ALTERNATE PORT 6103	TAG 1141	OUTPUT PORT 1142	AUXILIARY OUTPUT PORT 1143
11	N/A	N/A	41	TAG REMOVE UNIT SIDE	—
12	LINK 21 SIDE	LINK 24 SIDE	41	LINK 21 SIDE	LINK 24 SIDE
13	LINK 22 SIDE	N/A	41	LINK 22 SIDE	—
14	LINK 23 SIDE	N/A	41	LINK 23 SIDE	—
15	LINK 26 SIDE	LINK 24 SIDE	41	LINK 26 SIDE	LINK 24 SIDE
16	LINK 27 SIDE	N/A	41	LINK 27 SIDE	—

FIG.53

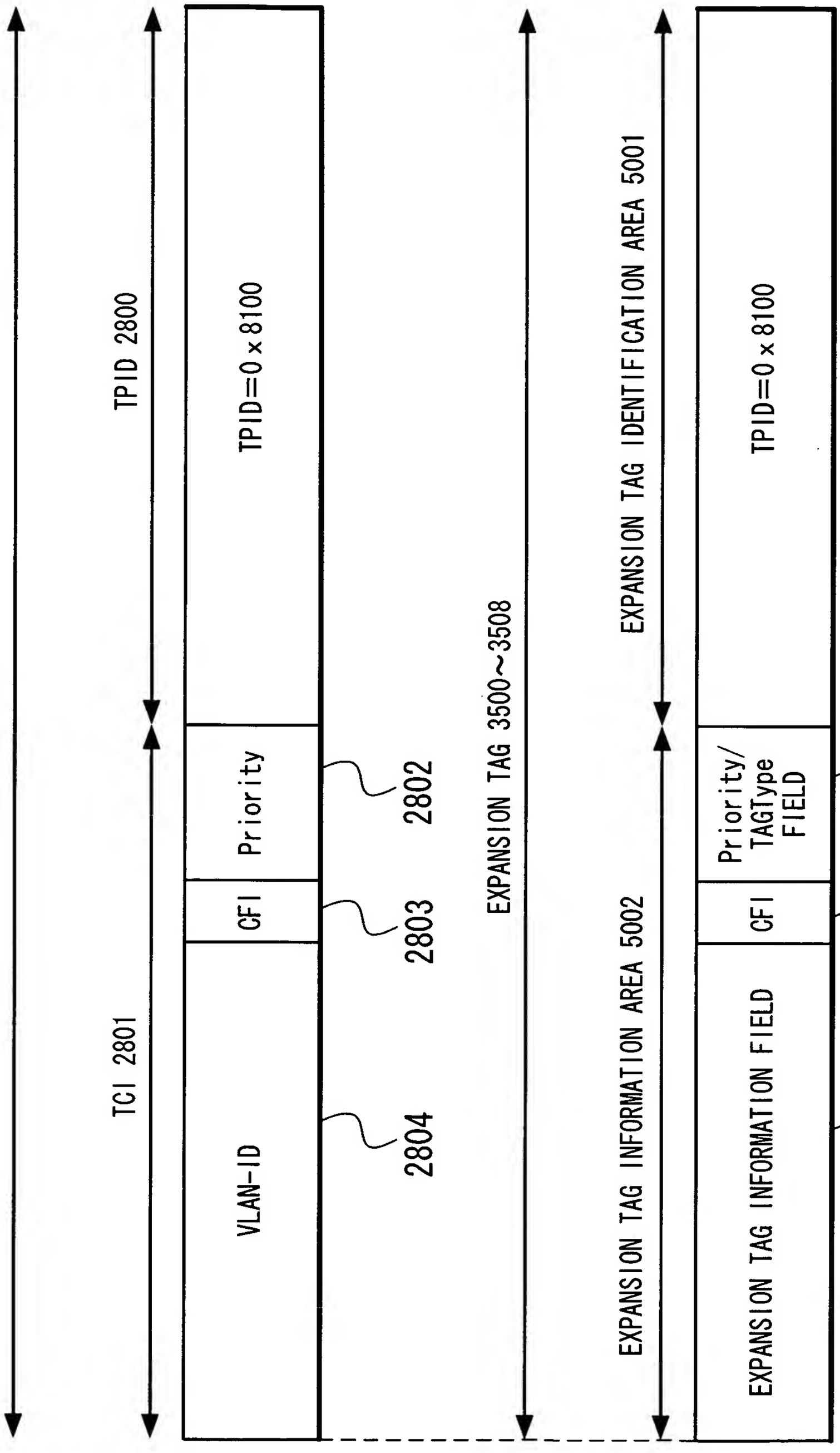
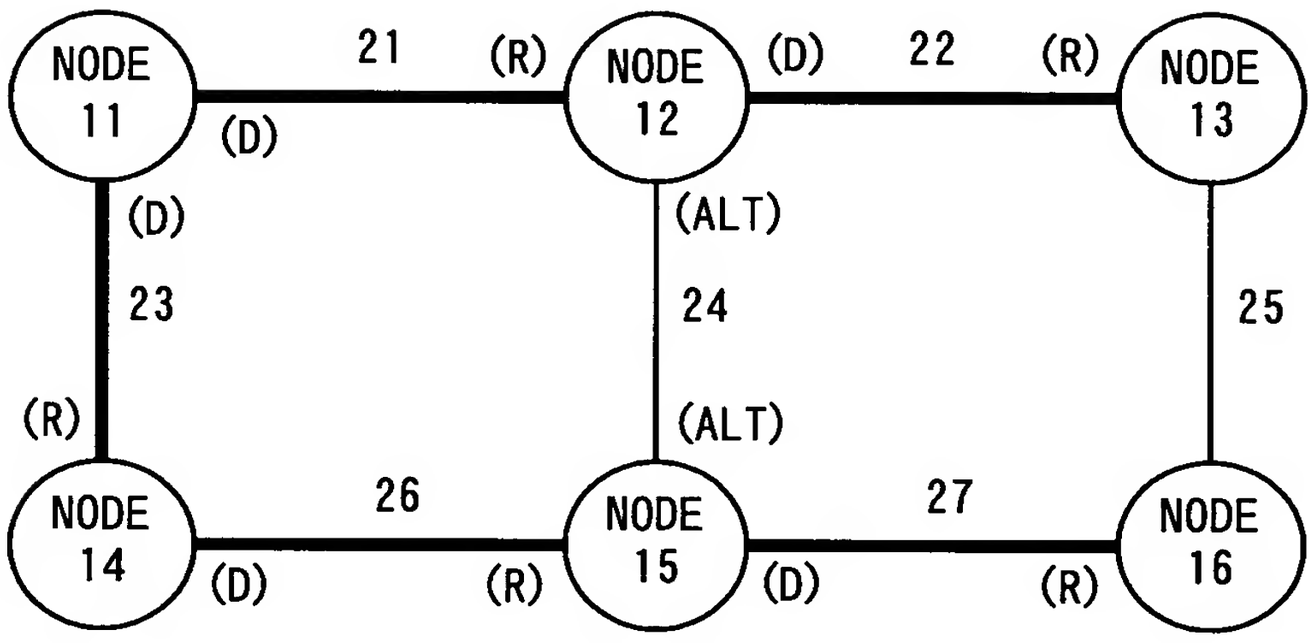

VLAN TAG 3203
TPID 2800
TPID=0×8100
TCI 2801
CFI
Priority
2803
2802
VLAN-ID
2804
EXPANSION TAG 3500~3508
EXPANSION TAG IDENTIFICATION AREA 5001
TPID=0×8100
EXPANSION TAG INFORMATION AREA 5002
FIELD
CFI
Priority/
TAGType
FIELD
2803
5003
EXPANSION TAG INFORMATION FIELD
5004

FIG.54


NODE 11
NODE 12
NODE 13
NODE 14
NODE 15
NODE 16
21
22
23
24
25
26
27
(R)
(D)
(ALT)